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IN THE

Supreme Court of the United States

OCTOBER TERM, 1974

No. 74-1555

KAISER INDUSTRIES CORPORATION, *et al.*, *Petitioners*

v.

JONES & LAUGHLIN STEEL CORPORATION, *Respondent*

PETITION FOR A WRIT OF CERTIORARI TO THE UNITED STATES COURT OF APPEALS FOR THE THIRD CIRCUIT

ARTHUR J. GOLDBERG
1101 Seventeenth St., N.W.
Washington, D.C. 20036

WILLIAM H. WEBB
WEBB, BURDEN, ROBINSON & WEBB, P.A.
515 Oliver Building
Pittsburgh, Pennsylvania 15222
Attorneys for Petitioners

H. DAVID ROSENBLOOM
PETER VAN N. LOCKWOOD
RICHARD E. TIMBIE
CAPLIN & DRYSDALE
1101 Seventeenth St., N.W.
Washington, D.C. 20036

JOHN M. WEBB
DAVID C. BRUENING
WEBB, BURDEN, ROBINSON & WEBB, P.A.
515 Oliver Building
Pittsburgh, Pennsylvania 15222
Of Counsel

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PETITION FOR A WRIT OF CERTIORARI TO THE UNITED STATES COURT OF APPEALS FOR THE THIRD CIRCUIT

Petitioners respectfully pray that a writ of certiorari issue to review the judgment and opinion of the United States Court of Appeals for the Third Circuit in this case.

OPINIONS BELOW

The opinion of the Court of Appeals, which is unofficially reported at 185 U.S.P.Q. 343 (1975), is set forth in the Appendix at pp. 1-41. The opinion of the District Court, which has not been reported, is set forth in the Appendix at pp. 43-593.

JURISDICTION

The judgment of the Court of Appeals was entered on April 4, 1975. (App. 42)[1] The jurisdiction of this Court is invoked under 28 U.S.C. § 1254(1).

QUESTIONS PRESENTED

1. Whether the Court of Appeals decided this case in a way in conflict with *Blonder-Tongue Laboratories, Inc.* v. *University of Illinois Foundation,* 402 U.S. 313 (1971), by refusing to accept the ultimate *Blonder-Tongue* test of collateral estoppel—a trial court's principled determination that it would not be "just and equitable to allow the plea of estoppel in the case before it"—and by holding instead that an estoppel plea must automatically be allowed because the prior proceeding on which the plea is based met the standards of procedural due process.

2. Whether in overruling the "mutuality" requirement of *Triplett* v. *Lowell,* 297 U.S. 638 (1936), this Court intended in *Blonder-Tongue* to erect (as the Court of Appeals did erect in this case) a bar to relitigation of patent validity issues which is more stringent than the general rule of collateral estoppel imposed in other areas of the law.

STATEMENT OF THE CASE[2]

Petitioners are Vereinigte Oesterreichische Eisen- und Stahlwerke Aktiengesellschaft ("VOEST"), a

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[1] References to the Appendix to this Petition are designated as "App." with a page number.

[2] The facts are extensively set forth in the opinions of the courts below and will only be summarized here.

steel company owned by the Austrian Government; Brassert Oxygen Technik AG. ("BOT"), a subsidiary of VOEST; and Kaiser Industries Corporation ("Kaiser"). VOEST holds the rights to the Basic Oxygen Process for refining steel (the "Basic Oxygen Process"), including the United States patent covering this process (the "Suess patent").[3] BOT holds worldwide rights to license the Basic Oxygen Process. Kaiser is the exclusive licensing agent for BOT in the United States.

Steelmaking involves two processes—smelting and refining. In the smelting process, iron ore is converted into molten pig iron in a blast furnace. In the refining process, molten pig iron is converted into steel by the removal of carbon, sulphur, phosphorus, and other impurities.

During the first half of the 20th century, most steel was refined by the "open-hearth" process, which involves "cooking" pig iron and scrap in large open-hearth furnaces heated by oil or gas. While this process produces satisfactory steel, it entails high capital and operating costs and requires from 10 to 12 hours for a single refining operation.

The Basic Oxygen Process is completely different from the open-hearth process and dramatically superior to it. Invented in 1949 by Dr. Theodor Suess and three colleagues working at the VOEST plant in Linz, Austria, the Basic Oxygen Process accomplishes refining by blowing a jet of oxygen vertically down

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[3] The Suess patent, the patent in suit, is reproduced at App. 805-12. The text of the patent specification and claims is set forth in more readable type at App. 813-34.

upon a "bath" of molten pig iron in a pear-shaped "basic oxygen furnace." Numerous experimenters—experts such as Schwarz, Miles, Durrer and Hellbruegge—had tried to develop such a process but had consistently failed, primarily because they conceived that refining could be achieved with oxygen only if the oxygen was blown deeply into the bath for the purpose of stirring or "agitating" the molten metal with the oxygen jet. Such "deep penetration" results in costly damage to the lining of the steelmaking furnace and does not produce high-quality steel. Dr. Suess and his colleagues discovered that efficient refining could be achieved only by avoiding deep penetration of the oxygen and material agitation of the bath by the physical action of the oxygen stream, and by relying instead upon chemical reactions in the surface center region of the bath to circulate the molten metal. This circulation brings all the metal into contact with the refining action of the oxygen, without damaging the lining of the furnace.

The Basic Oxygen Process is the first commercially practicable oxygen steelmaking process. Respondent's former president has characterized it as "the only major technological breakthrough at the ingot level in the steel industry since before the turn of the century." (App. 646) The process produces steel equal in quality to that produced by the open-hearths, but requires less than 40 minutes for a comparable refining operation. Moreover, the Basic Oxygen Process involves roughly one-half the capital costs of the open-hearth process, much lower operating costs, and substantial environmental advantages.

For these reasons, the Basic Oxygen Process has been adopted throughout the world. The record shows

that some ninety steel companies have installed the process, including every major steelmaker in the United States. By 1970, domestic production by this process had surpassed production by the open-hearth process, and the domestic steel industry had saved over $1.5 billion in capital costs and was saving some $300 million per year in operating costs by reason of its use of the Basic Oxygen Process. Today the savings attributable to the process are even greater, since no new open-hearth furnaces are being built and use of the Basic Oxygen Process continues to expand. Respondent alone, by its use of this process, has realized capital cost savings in excess of $81 million and is enjoying operating cost savings of about $16 million per year.

Steelmakers in 25 countries have paid substantial royalties for use of the Basic Oxygen Process. In the United States six steelmaking companies initially obtained licenses under the Suess patent covering the process, but those licenses have since been repudiated and American producers are presently litigating the validity of the Suess patent.[4]

That patent, which issued in 1957, has been the subject of two trials. The first was in *Henry J. Kaiser Co.* v. *McLouth Steel Corp.*, 257 F. Supp. 372 (E.D. Mich. 1966) (District Judge Ralph M. Freeman) (App. 654-805), *aff'd sub nom. Kaiser Industries Corp.* v. *McLouth Steel Corp.*, 400 F. 2d 36 (6th Cir. 1968) (App. 603-644), *cert. denied,* 393 U.S. 1119 (1969). The second trial was in this case, initiated against Jones & Laughlin Steel Corporation ("J & L") in

[4] Thirteen infringement actions brought by petitioners against the major American steel companies are presently in the discovery stage awaiting final disposition of this case.

the early 1960's[5] and tried in the United States District Court for the Western District of Pennsylvania (Judge Louis Rosenberg) from October 1967 through March 1968.[6]

In both cases the trial courts found:

—The Basic Oxygen Process was the first oxygen steelmaking process to make good steel and has been an overwhelming commercial success. (App. 139-40, 177-78, 511-12, 516, 651-53)

—The Basic Oxygen Process was a "revolutionary" invention and a "patentable advance" in the art of steelmaking. (App. 139, 646, 766, 802)

—The Basic Oxygen Process was neither anticipated by prior steelmaking art nor obvious at the time of its invention to persons skilled in that art. (App. 491-500, 504-16, 686-89, 715-16)

—The Basic Oxygen Process was invented by the Suess patentees. (App. 500-04, 744-46)

—The Suess patent, in its specification, describes the Basic Oxygen Process in full, clear, concise, and exact terms which have enabled persons skilled in the art to use that process. (App. 142-43, 523-36, 746-58)

The *McLouth* District Court, despite these conclusions, "reluctantly" held the Suess patent invalid. (App. 802) This holding was based on the *McLouth*

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[5] The case involves two consolidated actions, one brought by Kaiser in 1961 under 28 U.S.C. § 1332 for breach of an agreement licensing J & L to practice the Basic Oxygen Process at a designated J & L plant, and a second action brought by all three petitioners in 1962 under 28 U.S.C. § 1338(a) for infringement of the Suess patent at another, unlicensed, J & L plant.

[6] The record was subsequently reopened twice, as discussed at pages 10-11, *infra*.

District Court's conclusion that the final language of the Suess patent claims, as amended at the insistence of Examiners in the United States Patent Office, was defective. (App. 799)

Before amendment, the claims had referred to blowing oxygen onto a restricted impact area of the bath in such fashion as to "avoid deep penetration" of the oxygen jet into the molten metal. But at a conference in the Patent Office, Patent Examiners took the position that the concept of "avoiding deep penetration" taught in the specification should be expressed in claim language which, without changing the concept of the invention or broadening or narrowing the claims, would emphasize that the penetration of the oxygen jet is confined or localized in the surface center area of the bath, and that the oxygen jet is not used to stir or agitate the bath physically. (App. 206-08, 212) Accordingly, the final claims of the Suess patent, as amended and approved by the Patent Office, did not refer to "avoiding deep penetration" but instead referred to blowing oxygen "onto and below the surface of the bath at the central portion thereof, to an extent to avoid material agitation of the bath by the oxygen stream," the contact of the oxygen with the bath creating "a localized reaction zone spaced a substantial distance from the . . . lining [of the furnace] . . . ." (App. 834)

The specification was unaffected by the amendment and continued to refer to "avoiding deep penetration." Moreover, the amendment was accompanied by affidavits from two of the patentees showing that the terms "avoiding deep penetration" and "avoiding material agitation" are equivalent and cover the same concept. As the Patent Office requires, these affidavits

were placed in the "file wrapper" of the Suess patent and were publicly available for purposes of interpreting the patent claims as soon as the patent issued.[7]

The *McLouth* District Court ruled, however, that these affidavits could not be considered in assessing the meaning and scope of the Suess patent claims because persons reading the patent could not be held responsible "for knowing the contents of affidavits filed more than seven years" after the date of the invention.[8] (App. 776-77) Having thus excluded the clarifying affidavits from consideration, the *McLouth* District Court held:

> 1. "Avoiding deep penetration" is the exclusive "gist" of the Basic Oxygen Process, but that subject matter does not appear in the Suess patent claims as required by 35 U.S.C. § 112.[9] (App. 759-64)

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[7] It is stipulated that respondent's counsel ordered and received a copy of the complete file wrapper of the Suess patent, including the affidavits, upon issuance of the patent.

[8] This ruling, the effect of which was to exclude crucial evidence from consideration, was plainly wrong. There is no requirement in the law that patent claims be meaningful to a person skilled in the art *at the time when an invention is made*; the law is clear that claims are addressed to persons skilled in the art *at the time when a patent issues*. Clarifying material in the file wrapper of a patent is routinely referred to by persons skilled in the art in order to interpret the scope and meaning of patent claims, and such material must be considered by a court in passing on the validity of such claims. *Ellipse Corp.* v. *Ford Motor Co.*, 452 F.2d 163, 168 (7th Cir. 1971), *cert. denied*, 406 U.S. 948 (1972); *Autogiro Co. of America* v. *United States*, 384 F.2d 391, 397 (Ct. Cl. 1967); see *Graham* v. *John Deere Co.*, 383 U.S. 1, 33 (1966).

[9] The portion of 35 U.S.C. § 112 relied on by the *McLouth* District Court reads as follows: "The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention."

2. When the *words* "avoiding deep penetration" were removed from the claims, the *concept* of "avoiding deep penetration" was abandoned, and petitioners are barred by the doctrine of "file wrapper estoppel" from asserting that the Suess patent claims cover that concept.[10] (App. 764-67)

3. The claim language referring to blowing oxygen "to an extent to avoid material agitation of the bath by the oxygen stream" was neither supported by the Suess patent specification nor meaningful to those skilled in the art of steelmaking. (App. 768-86)

The *McLouth* District Court decided that the Suess patent was therefore invalid, and this decision was affirmed by the Sixth Circuit Court of Appeals. While the appellate court expressed doubts on the issue of obviousness, its holding rested squarely on the rationale adopted by the lower court regarding purported defects in the Suess patent claims. Like the District Court, the appeals court refused to consider the Suess

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[10] This issue had been neither pleaded nor argued by the defendant in *McLouth* but was raised *sua sponte* by the *McLouth* District Court, as respondent has stipulated. (App. 205) The doctrine of "file wrapper estoppel" requires that patent claims be "read and interpreted with reference to claims that have been cancelled or rejected and the claims allowed cannot by construction be read to cover what was thus eliminated from the patent." *Schriber-Schroth Co.* v. *Cleveland Trust Co.*, 311 U.S. 211, 220-21 (1940). However, the doctrine does not invariably apply when a claim is amended—only when an amendment serves to abandon concepts "in order to obtain the issuance of a patent by distinguishing the prior art." *Graham* v. *John Deere Co.*, 383 U.S. 1, 33 (1966); *Exhibit Supply Co.* v. *Ace Patents Corp.*, 315 U.S. 126, 136 (1942). The Suess patent claims were not amended to change concepts or "distinguish prior art" but solely because of the semantic preferences of the Patent Examiners. (App. 70-71, 206-16)

patentees' affidavits in interpreting those claims. Recognizing that "the issue of file wrapper estoppel hinges entirely upon the factual determination of abandonment or non-abandonment," the Sixth Circuit concluded that "an inference of abandonment can be drawn from the omission of 'avoidance of deep penetration' from the final claims." (App. 641-42) It observed, however, that "*the record is void* as to the content of the discussion with the Examiner" regarding amendment of the claims. (App. 641, emphasis supplied)

In light of the Sixth Circuit's observation of a "void" in the *McLouth* record—the first time any "void" in the evidence had been suggested—petitioners requested a rehearing and a remand from the appeals court for further findings on the factual question of abandonment. This request was denied. Subsequently, petitioners moved to reopen the record of this *J & L* case for the purpose of filling the alleged "void" noted by the Sixth Circuit.

Upon reopening, more than a year before *Blonder-Tongue* was decided, petitioners introduced the testimony of Claude A. LeRoy, the Primary Patent Examiner responsible for the Suess patent application in the Patent Office, and Byron T. Gardner, the attorney who represented the Suess patentees in the Patent Office. Both witnesses testified that the language of the Suess patent claims had been amended only to express the concept of "avoiding deep penetration" in different words; that the amendment did not result in abandonment of the concept of "avoiding deep penetration"; and that the amendment had been made solely because of the semantic preferences of the Patent Ex-

aminers and not to distinguish prior art. (App. 206-08, 211-12) Respondent objected to this testimony as parole evidence but offered no evidence of its own.

This Court's decision in *Blonder-Tongue* was handed down on May 3, 1971. Thereupon respondent reopened the case to plead collateral estoppel on the basis of the *McLouth* holding of invalidity. An evidentiary hearing was held on this issue, at which petitioners introduced the testimony of two former Commissioners of Patents, David L. Ladd and William E. Schuyler, and a former President of the American Patent Law Association, Roberts B. Larson. These witnesses testified that, under controlling legal principles and the practice of the Patent Office, the Suess patentees had not abandoned the concept of "avoiding deep penetration" in the Patent Office proceedings, and therefore no basis existed for the *McLouth* courts' invocation of file wrapper estoppel. (App. 208-11) Petitioners also introduced the testimony of Dr. John Elliott, a steelmaking expert, to the effect that the *McLouth* courts had failed to grasp key aspects of steelmaking technology, as demonstrated by internal inconsistencies in those courts' opinions. Respondent offered no evidence at this reopening.

On January 29, 1974, the District Court rendered its decision in this case, holding on the basis of detailed findings of fact and law that respondent's plea of estoppel must be denied under *Blonder-Tongue,* and that the Suess patent is valid and enforceable and has been infringed by respondent.[11] In accordance with the

[11] Findings relating to the collateral estoppel issue are set forth in an "Opinion Compendium—Collateral Estoppel" (App. 155-486) and summarized in an "Opinion Summary—Collateral Es-

test mandated by this Court in *Blonder-Tongue,* the District Court conducted a principled inquiry into the collateral estoppel issue and articulated reasons why it would be neither just nor equitable to allow the plea of estoppel in this case. The trial court's specific findings were as follows:

> 1. The *McLouth* courts had failed to grasp that the Basic Oxygen Process is a combination of several specific process steps taught in the Suess patent specification, all of which are carried over into the Suess patent claims; that the claim reference to "avoiding material agitation" embodies the same concept as "avoiding deep penetration"; and that "avoiding material agitation" means to the skilled steelmaker that, contrary to the beliefs and teachings of the prior art, he should not try to blow deeply for the purpose of materially stirring or agitating the molten metal with the oxygen jet. (App. 69-70, 76-80, 226-33, 298-303)
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> 2. The *McLouth* courts had failed to understand key technological aspects of the Basic Oxygen Process and had misconceived fundamental differences between that process and the prior art, which uniformly and mistakenly had relied upon deep penetration of the oxygen jet for the purpose of materially agitating the bath. (App. 66-67, 73, 77-78, 99-101, 144-46, 296-303, 350-54, 366-71, 378-79, 382)
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> 3. The *McLouth* courts had erred in refusing to consider the patentees' affidavits in the Suess patent file wrapper, which affidavits show that the concept of "avoiding deep penetration" was never abandoned. (App. 313-14, 450)

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toppel" (App. 43-153); the findings in the Opinion Compendium also serve as background for the District Court's decision on the merits in an "Opinion—The Jones & Laughlin Cases." (App. 487-593)

4. Because abandonment of the concept of "avoiding deep penetration" was an affirmative defense neither pleaded nor argued in *McLouth*, and because the *McLouth* courts erroneously ignored the file wrapper affidavits bearing on that issue, petitioners were deprived in *McLouth* of a reasonable opportunity to present the uncontroverted additional evidence introduced in this case which confirms that no abandonment occurred. (App. 222-23)

5. Petitioners should not be faulted under *Blonder-Tongue* for the absence of that additional evidence in *McLouth*, since the *McLouth* District Court's *sua sponte* finding of abandonment and holding of file wrapper estoppel were plainly wrong as a matter of law on the *McLouth* record and since the alleged "void" in the evidence on the abandonment issue was suggested for the first time in the opinion of the *McLouth* Court of Appeals. (App. 450-56)

6. Since the *McLouth* District Court believed that "avoiding deep penetration" was the exclusive "gist" of the Basic Oxygen Process, its finding that the Suess patentees had abandoned that concept was critical to its conclusion that the Suess patent claims were fatally defective under 35 U.S.C. § 112. (App. 144-45)

7. The *McLouth* Court of Appeals, in affirming, accepted the fundamental misconceptions of the *McLouth* District Court and failed to correct its errors. (App. 118-19, 145, 152)

For these reasons, the trial court in this case concluded that, under the standards of *Blonder-Tongue*, petitioners did not have a "fair opportunity procedurally, substantively and evidentially to pursue [their] claim" in *McLouth* and that it would be neither just nor equitable to apply collateral estoppel based

on *McLouth*. (App. 151-53) The *McLouth* proceedings, the District Court found, were "seriously defective," and had deprived petitioners of the fruits of a revolutionary invention on grounds which were not only highly technical but plainly wrong. (App. 152) The trial court considered its denial of the estoppel plea all the more appropriate because *McLouth* was litigated while *Triplett* v. *Lowell* was the law, and because this case offered a substantially more complete record on which to adjudicate the validity of the Suess patent than the record in *McLouth*. (App. 135-36, 221-23)

Having denied the plea of estoppel, the District Court addressed the merits of the case. It held that the Suess patent claims are sufficiently precise to fulfill the requirements of law, that the Suess patent is valid and enforceable in all other respects, and that J & L has breached its license agreement with Kaiser and infringed the Suess patent in its unlicensed operations.

The Third Circuit Court of Appeals reversed, holding that "the District Court was obliged to accept the defense of collateral estoppel." (App. 2) The Court of Appeals recognized that the Suess patent is the "fundamental" United States patent on the Basic Oxygen Process, that the process represents a "material technological advance" in the art of steelmaking which has achieved "remarkable success," and that all prior attempts at oxygen steelmaking "were never exploited commercially." (App. 3, 5) The Court of Appeals did not, however, decide the merits of the case. Its decision was premised solely on its conception of collateral estoppel under *Blonder-Tongue*, and was entirely "a matter of law." (App. 30)

REASONS FOR GRANTING THE WRIT

The Court should grant certiorari in this case in order to review the failure of the Court of Appeals to follow this Court's decision in *Blonder-Tongue Laboratories, Inc.* v. *University of Illinois Foundation,* 402 U.S. 313 (1971).

In *Blonder-Tongue* this Court partially overruled *Triplett* v. *Lowell,* 297 U.S. 638 (1936), and eliminated an anomaly which had existed in patent law for many years. *Triplett* had held that collateral estoppel would not bar a suit for infringement of a patent previously held invalid unless "mutuality" was established—that is, unless the parties to the second suit were the same as in the first. In *Blonder-Tongue* the Court noted that the mutuality requirement had been abandoned in other areas of the law and held that the *Triplett* rule for patent cases could no longer be justified. In so holding the Court enunciated certain criteria for determining when non-mutual collateral estoppel would or would not apply in patent cases:

> [W]e do not suggest, without legislative guidance, that a plea of estoppel by an infringement or royalty suit defendant must automatically be accepted once the defendant in support of his plea identifies the issue in suit as the identical question finally decided against the patentee or one of his privies in previous litigation. Rather, the patentee-plaintiff must be permitted to demonstrate, if he can, that he did not have "a fair opportunity procedurally, substantively and evidentially to pursue his claim the first time." . . . This element in the estoppel decision will comprehend, we believe, the important concerns about the complexity of patent litigation and the posited hazard that the prior proceedings were seriously defective.

> Determining whether a patentee has had a full and fair chance to litigate the validity of his patent in an earlier case is of necessity not a simple matter. In addition to the considerations of choice of forum and incentive to litigate mentioned above, certain other factors immediately emerge. For example, if the issue is nonobviousness, appropriate inquiries would be whether the first validity determination purported to employ the standards announced in *Graham* v. *John Deere Co.*, . . .; whether the opinions filed by the District Court and the reviewing court, if any, indicate that the prior case was one of those relatively rare instances where the courts wholly failed to grasp the technical subject matter and issues in suit; and whether without fault of his own the patentee was deprived of crucial evidence or witnesses in the first litigation. But as so often is the case, no one set of facts, no one collection of words or phrases, will provide an automatic formula for proper rulings on estoppel pleas. In the end, decision will necessarily rest on the trial courts' sense of justice and equity.
>
> . . . [T]he court in the second litigation must decide in a principled way whether or not it is just and equitable to allow the plea of estoppel in the case before it. 402 U.S. at 333-34. (footnotes and citations omitted)

Thus, in partially overruling *Triplett, Blonder-Tongue* mandated a fair and flexible approach to the estoppel determination in patent cases. It described examples of "appropriate inquiries" bearing on that determination and ultimately referred the determination to the trial courts' principled "sense of justice and equity."

In this case the Court of Appeals refused to accept the ultimate *Blonder-Tongue* test. It disregarded a principled determination by the trial court that, for

reasons of justice and equity, respondent's estoppel plea should be denied. And it read *Blonder-Tongue* as erecting a virtually absolute bar to any action to enforce a patent previously held invalid. The net effect of the Court of Appeals' holding, unless reversed by this Court, is to replace *Triplett's* unduly lenient rule, and *Blonder-Tongue's* flexible approach, with a new rule in patent cases which is far more stringent than the collateral estoppel rule applied generally in other areas of the law.

The test applied by the Court of Appeals represents the culmination of a trend among lower federal courts, which apparently have come to believe that *Blonder-Tongue* automatically precludes relitigation of patent validity issues, except perhaps when a patentee-plaintiff can demonstrate a denial of procedural due process in the first litigation. *Blonder-Tongue* did not so hold. And this case affords the Court an opportunity to make clear not only to the Third Circuit but to other federal courts that *Blonder-Tongue* is not intended as an absolute bar to relitigation but, on the contrary, that *Blonder-Tongue* means what it plainly says.

DISCUSSION

I. The Court of Appeals Decided This Case in a Way in Conflict With Blonder-Tongue by Refusing To Accept the Ultimate Blonder-Tongue Test—a Trial Court's Principled Determination That It Would Not Be "Just and Equitable To Allow the Plea of Estoppel in the Case Before It"—and by Holding Instead That Collateral Estoppel Must Automatically Be Applied Because the McLouth Proceedings Met the Standards of Procedural Due Process.

In reversing the District Court, the Court of Appeals applied an erroneous and excessively rigid stand-

ard of collateral estoppel which is not consistent with the language or the rationale of *Blonder-Tongue*. The Court of Appeals reasoned as follows: First, "the *sole* ground explicitly recognized by the Supreme Court to defeat a motion for summary judgment made in the second case and premised on *Blonder-Tongue* is that the first adjudication did not provide a 'full and fair opportunity to litigate.'" (App. 24, emphasis supplied) Second, the *Blonder-Tongue* "guidelines suggested for reaching a result permitting relitigation are replete with qualifying words making a patentee's burden onerous." (App. 24) Third, the *Blonder-Tongue* reference to "justice and equity" does not "constitute a departure from the exacting language used by the Supreme Court earlier in the same paragraph of its opinion." (App. 25)

The Court of Appeals thus adopted an interpretation of *Blonder-Tongue* under which a collateral estoppel plea must automatically be accepted unless one of the express "guidelines" of *Blonder-Tongue* applies —that is, unless petitioners could demonstrate that, "without fault of [their] own," they were deprived of "crucial evidence or witnesses" in *McLouth*; or that *McLouth* was "one of those relatively rare instances where the courts wholly failed to grasp the technical subject matter and issues in suit."[12] The Court of Appeals concluded that the deprivation of evidence in *McLouth*, as found by the District Court, did not fall within the "guidelines" because the evidence in question was not "crucial" and petitioners were not "without fault" in failing to present it in *McLouth*. (App.

[12] 402 U.S. at 333. The full text of the *Blonder-Tongue* "guidelines" cited by the Court of Appeals is set forth at pp. 15-16, *supra*.

32-33) The appeals court also concluded that the *McLouth* tribunals had not "wholly failed to grasp the technical subject matter and issues in suit," since "Judge Freeman . . . allocated an unusual amount of time to the trial, and devoted considerable effort to understanding the underlying industrial and scientific principles," "conducted intelligent questioning," and "produced a comprehensive and comprehensible opinion." (App. 34-35)

The Court of Appeals made two fundamental errors in holding that the plea of estoppel must be accepted in this case. First, it disregarded the fact that the *Blonder-Tongue* "guidelines" were not described as such in *Blonder-Tongue* but were stated to be merely *"appropriate inquiries"* bearing on the estoppel determination. This Court made it clear that these "appropriate inquiries" were illustrative and that the ultimate test of estoppel was: "in the end, decision will necessarily rest on the trial courts' [principled] sense of justice and equity." Second, even if it is assumed *arguendo* that the "appropriate inquiries" are the sum total of the collateral estoppel test in patent cases, the Court of Appeals misinterpreted those "appropriate inquiries" by applying them in a rigid and unreasonable way. Under any reasonable interpretation, the "appropriate inquiries" dictate that the estoppel plea be rejected in this case.

Blonder-Tongue held that the *Triplett* requirement of "mutuality" is neither "essential to effectuate the purposes of the patent system" nor "an indispensable or even effective safeguard against faulty trials and judgments." 402 U.S. at 334. Therefore, the Court concluded, "*Triplett* should be overruled to the extent it forecloses a plea of estoppel by one facing a charge of

infringement of a patent that has once been declared invalid." *Id.* at 350. However, this Court explicitly declined to erect an "automatic" rule of collateral estoppel; repeatedly it expressed a concern for fairness to litigants and flexibility in decision-making. *Id.* at 328, 333-35, 349.[18] Thus the Court held that the standards for applying non-mutual estoppel in patent cases would include pragmatic considerations—illustrated by "appropriate inquiries"—under which relitigation would be allowed if the prior proceeding did not afford the patentee-plaintiff a "full and fair chance to litigate" or was otherwise "seriously defective." *Id.* at 333. And ultimately, the decision whether to apply estoppel would rest upon the judgment of the trial court in the second litigation, which was enjoined to "decide in a principled way whether or not it is just and equitable to allow the plea of estoppel in the case before it." *Id.* at 334.

In this case the trial court scrupulously followed the *Blonder-Tongue* instructions for passing upon estoppel pleas. It decided "in a principled way" that, for reasons of justice and equity, estoppel should not apply here. And it based that decision on specific findings which are fully supported by the record:

> —The Basic Oxygen Process is a great and patentable invention, and the *McLouth* courts' decision to strike down the patent on that invention rested

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[18] Neither party in *Blonder-Tongue* had argued that *Triplett* should be overruled. 402 U.S. at 318-19. The Government, which did take the position that the mutuality requirement should be removed in patent cases, contended that "*a flat rule of estoppel would not be warranted.*" Brief for the United States as Amicus Curiae, p. 34 (emphasis supplied).

on grounds which were not only hypertechnical but plainly wrong. (App. 151-53) [14]

—The *McLouth* courts' belief that the Suess patent claims were indefinite reflected a fundamental misinterpretation of expert testimony and scientific fact. (App. 144-46)

—The *McLouth* courts' *sua sponte* finding of abandonment of the concept of "avoiding deep penetration," and their invocation of file wrapper estoppel, were plainly erroneous in light of the affidavits in the Suess patent file wrapper and other relevant evidence. (App. 449-55)

—New evidence presented in this case demonstrates beyond any doubt that the concept of "avoiding deep penetration" was never abandoned. (App. 223, 540-545).[15]

—The *McLouth* courts' belief that the concept of "avoiding deep penetration" had been abandoned permeated their discussion of the Suess patent claims and formed the basis for the *McLouth* invalidity decision. (App. 144-45)

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[14] The Court's decision in *Blonder-Tongue* addresses itself in the main to situations in which patent invalidity is based on anticipation, obviousness, inventorship, and the like—all matters precluding the issuance of any patent to the prospective patentee. 402 U.S. at 343, 344-50. The *McLouth* holding of invalidity was expressly premised not on such issues of patentability but solely upon the language employed in the claims of the Suess patent.

[15] This new evidence—the testimony of Patent Examiner LeRoy and attorney Gardner—conclusively shows that the words "avoiding deep penetration" were removed from the Suess patent claims not to change the concepts covered by those claims or to distinguish prior art but solely because of the semantic preferences of the Patent Office. See pp. 10-11, *supra*. In these circumstances, there is no abandonment and file wrapper estoppel does not apply. See n. 10, *supra*.

—The record in this case is more complete and permits a better undersanding of the issues than the record before the *McLouth* courts. (App. 223, 545)

The Court of Appeals did not question these findings, much less find them clearly erroneous; it simply ignored them. It thus rejected the District Court's common-sense inquiry into the fundamental defects of the *McLouth* proceeding. And, declining to "acquiesce" in a principled determination based on the trial court's sense of justice and equity (App. 25), the Court of Appeals refused to follow the ultimate *Blonder-Tongue* test.[16]

Instead, the Court of Appeals applied an inflexible test of its own which cannot be reconciled with the *Blonder-Tongue* decision. Failing to heed the *Blonder-Tongue* admonition that "no one set of facts, no one collection of words or phrases will provide an automatic formula for proper rulings on estoppel pleas," 402 U.S. at 333-34, the Court of Appeals relied exclusively on a narrow reading of certain words and phrases ap-

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[16] The Court of Appeals charged petitioners with reliance upon "generalized concepts of justice and equity" and the District Court with "unarticulated and unreviewable determinations." (App. 25) Neither of these characterizations is apt. Petitioners have consistently recognized—as *Blonder-Tongue* holds—that on the question whether the prior case afforded a "full and fair chance to litigate," the trial courts' "sense of justice and equity" must be exercised in "principled" fashion. See pp. 22, 23, and 33 of the Brief for Plaintiffs-Appellees in the Third Circuit, a copy of which has been lodged with the Clerk of this Court for the convenience of the Court. And it cannot reasonably be denied that the District Court in this case did make, and articulate, a "principled" determination under *Blonder-Tongue*. (App. 44-486) However, the Court of Appeals considered itself free to ignore both that determination and the trial court's findings of fact.

pearing in the *Blonder-Tongue* opinion and disregarded this Court's caveat that these words and phrases should not be exalted to the status of an "automatic formula." And the Court of Appeals then compounded its error by misinterpreting the very words and phrases on which it relied.

A. "... *deprived of crucial evidence* ..."

One example of an "appropriate inquiry" mentioned in *Blonder-Tongue* as bearing on the question of what constitutes a "full and fair chance to litigate" is "whether without fault of his own the patentee was deprived of crucial evidence or witnesses in the first litigation." 402 U.S. at 333. The Court of Appeals held that petitioners had not been deprived of "crucial" evidence in the *McLouth* case because the evidence in question—demonstrating that the concept of "avoiding deep penetration" had not been abandoned—might not have changed the *McLouth* result. The Court of Appeals reached this conclusion because it believed the *McLouth* judgment of invalidity rested on "independent grounds"—defects in the claim language *and* abandonment of the concept of "avoiding deep penetration." (App. 32)

This holding of the Court of Appeals reflected an unreasonable reading of the *Blonder-Tongue* term "crucial." The "independent grounds" of indefiniteness and abandonment were inextricably intertwined in *McLouth*: The *McLouth* District Court's finding that what it considered to be the exclusive "gist" of the Basic Oxygen Process—the concept of "avoiding deep penetration"—had been abandoned in drafting the Suess patent claims inevitably led that court to find the claims defective. Thus, the issue of aban-

donment lay at the heart of the *McLouth* holding of invalidity. Moreover, vital evidence bearing upon a principal ground for a court's decision is "crucial" within the meaning of *Blonder-Tongue,* even if other grounds for the decision appear to exist.[17]

B. *". . . without fault of their own . . ."*

The Court of Appeals next adopted a highly technical and unreasonable construction of the *Blonder-Tongue* term "fault," holding that the deprivation of evidence on the abandonment issue in *McLouth* was not "without fault" of the petitioners. (App. 33) The Court of Appeals reasoned that petitioners' counsel on the *McLouth* appeal had "relied on the legal argument that no file wrapper estoppel should obtain" and did not argue that "crucial" evidence was lacking in the *McLouth* record. (App. 32) The Court of Appeals charged petitioners with "now . . . [assuming] a different posture and [raising] . . . objections to the *McLouth* proceeding that are bottomed, not on the legal aspects of file wrapper estoppel, but rather on the foreclosure of evidence. In the absence of a compelling reason why [they] . . . could not have raised this objection at the time of the *McLouth* appeal, [petitioners are] . . . not at liberty to voice such a protest here." (App. 32-33)

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[17] While a judgment based on alternative grounds can give rise to collateral estoppel in a subsequent case in which both grounds apply, such a judgment does not estop the defeated party on any one of the grounds standing alone. *Halpern* v. *Schwartz,* 426 F.2d 102, 105 (2d Cir. 1970); *Restatement (Second) Judgments,* § 68, Comment (*i*), at 155-57 (Tent. Draft No. 1, 1973). Therefore, the Court of Appeals erred in denying the "crucial" nature of the evidence in question on the basis of an "alternative" ground for the *McLouth* judgment.

This analysis is erroneous not only because it is unreasonably rigid, but also because its premises are incorrect:

—Petitioners *did* raise the "foreclosure of evidence" point on appeal in *McLouth*. In their petition for rehearing in the Sixth Circuit, after that court's opinion had referred to an alleged significant "void" in the *McLouth* record (a "void" suggested in the Sixth Circuit opinion for the first time in the entire course of the *McLouth* proceedings), petitioners urged that "if the Court is in doubt, it should remand the case for findings on the *factual* question of abandonment."[18]

—It was not until the Sixth Circuit affirmed the *McLouth* District Court, disregarding the Suess patentees' affidavits in the Suess file wrapper and calling attention to the purported "void" in the record, that further evidence on the abandonment issue became "crucial."[19]

—It simply is not the case that petitioners took a "different posture" in this litigation from their posture in *McLouth*. Petitioners contend that they were deprived in *McLouth* of the opportunity to present crucial evidence; but that is not the sole ground on which they have objected to the *McLouth* invocation of file wrapper estoppel and their objections are certainly not "bottomed" on it alone. Petitioners have consistently maintained,

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[18] Plaintiffs-Appellants' Petition for Rehearing in the Sixth Circuit, p. 9 (emphasis in original). A copy of this Petition has been lodged with the Clerk of this Court for the convenience of the Court.

[19] The *McLouth* District Court's finding of abandonment was so clearly erroneous that McLouth did not seek to support that finding on appeal. See Brief of McLouth Steel Corporation in the Sixth Circuit. A copy of this Brief has been lodged with the Clerk of this Court for the convenience of the Court.

> and continued to maintain before the Third Circuit, that the *McLouth* courts committed legal error on the record of the *McLouth* trial by refusing to consider the affidavits in the Suess patent file wrapper and that, in light of those affidavits, file wrapper estoppel was improperly invoked in *McLouth*.[20]

Further, the Third Circuit erroneously chose to disregard the District Court's conclusion that, since *McLouth* was fully litigated while *Triplett* v. *Lowell* was the law, it would not be fair to "fault" petitioners under *Blonder-Tongue* for the absence of additional evidence on the abandonment issue in *McLouth*. (App. 221-22) Consideration of this point by the District Court was clearly appropriate under the flexible *Blonder-Tongue* approach to collateral estoppel.

C. ". . . *wholly failed to grasp* . . ."

Another "appropriate inquiry" mentioned in *Blonder-Tongue* is "whether the opinions filed by the District Court and the reviewing court, if any, indicate that the prior case was one of those relatively rare instances where the courts wholly failed to grasp the technical subject matter and issues in suit." 402 U.S. at 333. The Court of Appeals held that the *McLouth* courts had not "wholly" failed to grasp the technical subject matter and issues because it appeared, from the face of those courts' opinions, that they "came to conclusions *not altogether in disregard* of the relevant technology, the evidence presented, and the governing principles of law." (App. 40, emphasis supplied) However, petitioners do not contend that the

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[20] See Brief for Plaintiffs-Appellees in the Third Circuit, pp. 25-26.

McLouth courts altogether disregarded or failed to ununderstand all of the issues in the case before them. They do contend—and the District Court in this case held—that the *McLouth* courts failed to grasp significant technical matters bearing upon the proper construction of the Suess patent claims, and that the construction of the claims has become the key issue in this litigation.

The *McLouth* courts' fundamental technical errors lay in failing to recognize that the Basic Oxygen Process represents a composite of numerous features, all of which appear in both the Suess patent specification and the Suess patent claims and, in particular, that the claim reference to "avoiding material agitation" embodies the very same concept as the specification references to "avoiding deep penetration." These errors were apparent to the *J & L* District Court from the *McLouth* opinions and record. While the Court of Appeals decried the scope of the District Court's "extraordinary wide-ranging scrutiny of the first trial" (App. 39), it apparently failed to note that this case was fully tried before *Blonder-Tongue* was decided and that much of the record in *McLouth* had been incorporated in the record of this case by stipulation of the parties. Thus the Court of Appeals criticized the District Court for failing to disregard for purposes of the collateral estoppel determination what the District Court already knew about the *McLouth* record and the issues in suit long before the plea of collateral estoppel was even raised.

* * *

Under the Court of Appeals' test, collateral estoppel must apply unless either (a) evidence which would

necessarily change the result in a prior proceeding was not before the prior court and such evidence could not have been discovered by the patentee-plaintiff; or (b) the opinions in the previous case were, on their face, unresponsive to the issues in suit or wholly unintelligible. This is surely not the test of *Blonder-Tongue.* Contrary to *Blonder-Tongue,* the Court of Appeals' test would make collateral estoppel an automatic and absolute bar to any action to enforce a patent previously held invalid, as long as the prior action did not involve an error of constitutional dimensions. And contrary to *Blonder-Tongue,* the Court of Appeals' test would remove the collateral estoppel determination from the trial court and permit the reviewing court to disregard both the trial court's findings of fact and its "sense of justice and equity."

The Court of Appeals found support for its rigid approach in decisions such as *Blumcraft of Pittsburgh* v. *Kawneer Co., Inc.,* 482 F.2d 542 (5th Cir. 1973); *Sampson* v. *Ampex Corp.,* 478 F.2d 339 (2d Cir. 1973); and the decision in *Blonder-Tongue* itself following remand from this Court, 334 F. Supp. 47 (N.D. Ill. 1971). While these cases do not involve considerations of fairness such as those identified by the trial court in this case, it is true that dicta in the cited decisions seem to reflect a very narrow reading of *Blonder-Tongue.* In *Blumcraft of Pittsburgh,* for example, the Court of Appeals stated that "*Blonder-Tongue* did not throw merely a jab at the multiplicity of patent litigation; rather, it intended a *knockout blow* through the doctrine of collateral estoppel." 482 F.2d at 549 (emphasis supplied). The *Sampson* court referred to "egregious error" in the prior case as the only available *Blonder-Tongue* exception. 478 F.2d at 342. And

in *Blonder-Tongue* on remand, the District Court suggested that "the second court must defer unless it appears from the face of the prior opinions that the first court *completely missed the point.*" 334 F. Supp. at 50 (emphasis supplied).

Thus it would appear that the Court of Appeals is not alone in interpreting *Blonder-Tongue* as a virtually automatic bar to relitigation of patent validity issues. Although the lower courts, like the Court of Appeals here, pay lip service to the notion that estoppel will not apply in some cases, upon analysis it is likely that no case will ever meet the stringent standards that have been erected. And this is particularly apparent in light of the Court of Appeals' decision in this case, which drains the last vestige of flexibility from *Blonder-Tongue*.

II. The Court of Appeals' Interpretation of Blonder-Tongue Erects an Even More Stringent Bar to Relitigation of Patent Validity Issues Than the General Rules of Collateral Estoppel Applied in Other Areas of the Law.

A further consequence of the Court of Appeals' interpretation of *Blonder-Tongue* is that it would bar relitigation of patent validity issues to a greater extent than the general rule of collateral estoppel precludes relitigation in other areas of the law. Nothing in the *Blonder-Tongue* decision suggests that this Court intended such a result when it overruled the mutuality requirement of *Triplett*.

Numerous cases from the general law of collateral estoppel have held that a plea of estoppel must be denied, despite a prior adjudication meeting the standards of due process, where (a) application of estoppel would work an injustice, (b) the decision of the prior

court was plainly wrong, or (c) the availability of evidence not before the prior court or other considerations give reason to believe that the second court will be in a substantially better position than the prior court to reach a correct result.[21] Under such authorities, the findings of fact of the District Court fully support denial of the estoppel plea in this case.

The *Restatement (Second) of Judgments,* in its present version, also makes it clear that the test of collateral estoppel applied by the Court of Appeals is substantially more stringent than the test applied generally. Like *Blonder-Tongue,* the *Restatement* calls for a threshold inquiry whether the issue in suit was "actually litigated and determined" in a prior action and whether the party against whom collateral estoppel is asserted was afforded "an adequate opportunity or incentive to obtain a full and fair adjudication" of the issue in the prior proceeding.[22] When, as in this case, the estoppel plea is asserted by a person not a party to the prior action, the *Restatement* provides that estoppel must be denied if special circumstances

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[21] *La Societe Anonyme des Parfums LeGalion* v. *Jean Patou, Inc.,* 495 F.2d 1265, 1276 (2d Cir. 1974), and authorities there cited; *Menendez* v. *Saks and Co.,* 485 F.2d 1355, 1363-64 (2d Cir. 1973), and authorities there cited; *Grantham* v. *McGraw Edison Company,* 444 F.2d 210, 216-17 (7th Cir. 1971); *Berner* v. *British Commonwealth Pacific Airlines, Ltd.,* 346 F.2d 532, 538-41 (2d Cir. 1965); *Spilker* v. *Hankin,* 188 F.2d 35, 37-38 (D.C. Cir. 1951); *Henderson* v. *Bardahl International Corp.,* 72 Wash. 2d 109, 118-19, 431 P.2d 961, 967-68 (1967).

[22] *Restatement (Second) Judgments,* § 68.1 (Tent. Draft No. 1, 1973). The official comments to this *Restatement* draft state that "full and fair adjudication" is not a due process test but an inquiry into "unfairness," and that the trial court's "discretion to deny preclusive effect" is "central to the fair administration" of the collateral estoppel doctrine. *Id.,* Comment (*j*), at 182-83.

—whether or not amounting to denial of a party's full and fair opportunity to litigate—"make it appropriate that the party be permitted to relitigate the issue."[23] The official comment to this provision states:[24]

> Important among such other circumstances is the disclosure that the prior determination was *plainly wrong* or that *new evidence has become available that could likely lead to a different result.* It is unnecessary that the party seeking to avoid preclusion show, as he must in seeking to set aside a judgment, that the evidence could not have been discovered with due diligence; *the question is not whether a prior determination should be set aside but whether it should be treated as conclusive for further purposes.*

The Reporters of the *Restatement* cite as authority for this proposition decisions in non-patent cases as well as this Court's decision in *Blonder-Tongue.*[25]

The limitations on collateral estoppel under the Court of Appeals' test are much more restrictive than those recognized in the *Restatement.* While the *Restatement* test requires only that evidence which was not before the prior court "could likely lead to a different result," the Court of Appeals would require that the evidence be, *per se*, determinative. While the *Restatement* test requires only a showing that new evidence has become available, the Court of Appeals would require the plaintiff to prove that he bears no

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[23] *Restatement (Second) Judgments,* § 88(7) (Tent. Draft No. 2, 1975).

[24] *Id.,* Comment (*i*), at 97 (emphasis supplied).

[25] *Id.,* Reporter's Note, at 101-02.

responsibility whatever for the absence of that evidence in the first proceeding. And while the *Restatement* test would require appropriate inquiry to determine whether the first court was "plainly wrong," the Court of Appeals would bar such inquiry as long as the opinions in the first case, without reference to the record of that case, are "internally consistent" and "appear compatible . . . with the language of the patent at issue and the principles of controlling law." (App. 36) [26]

The official notes to the *Restatement* summarize the test of non-mutual estoppel as follows: "The ultimate question is whether there is good reason, all things considered, to allow the party to relitigate the issue." [27] Under this test the findings of fact by the District Court in this case not only support rejection of the estoppel plea—they require it. The question posed in this case, and which only this Court can answer, is whether *Blonder-Tongue* was intended to pass from the rule of *Triplett* precluding non-mutual collateral estoppel in patent cases to a rule of virtually automatic estoppel unknown to the rest of the law.

CONCLUSION

By the time *Blonder-Tongue* was decided, this case had been fully tried on the merits, much of the record

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[26] The Court of Appeals' limitation of the trial court's inquiry is clearly inconsistent with this Court's instruction on remand of the *Blonder-Tongue* case that the patentee should "be permitted . . . to supplement the record with *any evidence* showing why an estoppel should not be imposed . . . ." 402 U.S. at 350 (emphasis supplied).

[27] *Restatement (Second) Judgments*, § 88(7) (Tent. Draft No. 2, 1975) Reporter's Note, at 102.

in *McLouth* had been incorporated in the record by stipulation of the parties, and the original trial record had been supplemented with new evidence, not before the *McLouth* courts, on the key issue of abandonment. After the *Blonder-Tongue* decision was rendered, and in accordance with that decision, the District Court took additional evidence on the collateral estoppel issue, made a careful and conscientious review of the voluminous record before it, and applied the *Blonder-Tongue* standard for ruling on estoppel pleas. On the basis of extensive findings of fact supported by the record, it held that respondent's plea of collateral estoppel must be denied under *Blonder-Tongue.*

Without questioning any of the District Court's findings of fact, the Court of Appeals held as a matter of law that respondent's plea of collateral estoppel must be accepted. In reaching this holding the Court of Appeals ignored the trial court's principled decision under *Blonder-Tongue* and interpreted *Blonder-Tongue* as establishing a virtually absolute bar to relitigation of patent validity issues.

The test of collateral estoppel applied by the Court of Appeals is contrary to this Court's decision in *Blonder-Tongue* and substantially more restrictive than the collateral estoppel rule applied in other areas of the law. That erroneous test represents the culmination of a trend in the lower federal courts. The effect of its application in this case, unless reversed by this Court, will be to preclude petitioners from enforcing the patent on a great invention despite the fact that that patent satisfies all requirements of law and was found invalid in *McLouth* on grounds that were both hypertechnical and plainly wrong.

In a recent address, C. Marshall Dann, United States Commissioner of Patents and Trademarks, said the following about a hypertechnical approach to the disposition of patent cases:

> Too often we allow the process of obtaining and enforcing patents to be controlled by matters having little to do with the merits of the inventions at issue.
>
> To make the patent system provide its much needed incentives, all concerned—patent examiners, patent lawyers, judges in patent cases and legislators should concentrate their efforts on two things: to assure patent protection for patentable inventions and to deny protection for unpatentable ones. It should be of distinctly secondary concern whether the attorney may have used poor judgment in the way he drew the claims, in his prosecution tactics, or even in whether he told the Patent and Trademark Office about every potential reference he may have known of.
>
> In this context, the only things that are really matters of substance are whether the invention is new, useful and unobvious and whether it is adequately disclosed in the patent specification. Everything else can be thought of as form.
>
> When an invention is new, useful and unobvious and is suitably disclosed, the public has received everything the patent laws are intended to give it in return for the grant of a patent. (Address before the Southwestern Legal Foundation, Dallas, Texas, March 7, 1975, reprinted in 8 *World Technology,* April 1975, at 17.)

It is petitioners' view that Commissioner Dann's observations are pertinent to both the determination of patent validity and the collateral estoppel issue addressed in this Petition.

For the foregoing reasons, this Court should issue a writ of certiorari to review the opinion and judgment of the Court of Appeals.

Respectfully submitted,

ARTHUR J. GOLDBERG
1101 Seventeenth St., N.W.
Washington, D.C. 20036

H. DAVID ROSENBLOOM
PETER VAN N. LOCKWOOD
RICHARD E. TIMBIE
CAPLIN & DRYSDALE
1101 Seventeenth St., N.W.
Washington, D.C. 20036

WILLIAM H. WEBB
WEBB, BURDEN, ROBINSON
& WEBB, P.A.
515 Oliver Building
Pittsburgh, Pennsylvania 15222
Attorneys for Petitioners

JOHN M. WEBB
DAVID C. BRUENING
WEBB, BURDEN, ROBINSON
& WEBB, P.A.
515 Oliver Building
Pittsburgh, Pennsylvania 15222
Of Counsel

SUPREME COURT, U. S.

FILED

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IN THE

Supreme Court of the United States

OCTOBER TERM, 1974

No. 74-1555

KAISER INDUSTRIES CORPORATION, *et al., Petitioners*

v.

JONES & LAUGHLIN STEEL CORPORATION, *Respondent*

APPENDIX TO PETITION FOR A WRIT OF CERTIORARI TO THE UNITED STATES COURT OF APPEALS FOR THE THIRD CIRCUIT

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OPINION OF THE COURT BELOW

UNITED STATES COURT OF APPEALS FOR THE THIRD CIRCUIT

No. 74-1312

KAISER INDUSTRIES CORPORATION, *Plaintiff-Appellee*

v.

JONES & LAUGHLIN STEEL CORPORATION,
Defendant-Appellant

KAISER INDUSTRIES CORPORATION,
VEREINIGTE OESTERREICHISCHE EISEN-UND
STAHLWERKE AKTIENGESELLSCHAFT, and
BRASSERT OXYGEN TECHNIK, A.G., *Plaintiffs-Appellees*

v.

JONES & LAUGHLIN STEEL CORPORATION,
Defendant-Appellant

On Appeal from the United States District Court
for the Western District of Pennsylvania

[Entered April 4, 1975]

ADAMS, *Circuit Judge*

Before the landmark case of Blonder-Tongue Laboratories, Inc. v. University of Illinois Foundation[1] was catapulted onto the legal horizon, the rule was that no general collateral estoppel effect attached to a judicial determination of patent invalidity. In *Blonder-Tongue,* the Supreme Court held that a prior adjudication of invalidity may be asserted as a defense to a subsequent attempt to enforce the patent, and that such defense must be accepted unless it is demonstrated that the patentee was denied a full and fair opportunity to litigate in the earlier action.

The plaintiffs here sought to enforce a patent that had been held invalid in a previous suit.[2] The defendant asserted the defense of collateral estoppel, but the district court refused to accept it.[3] Since in the first suit the patentees were afforded a full and fair opportunity to litigate that satisfied the criteria established in *Blonder-Tongue,* we hold that the district court was obliged to accept the defense of collateral estoppel.

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1. 402 U.S. 313 (1971).

2. Henry J. Kaiser Co. v. McLouth Steel Corp., 257 F. Supp. 372 (E.D. Mich. 1966), *aff'd sub nom.* Kaiser Industries Corp. v. McLouth Steel Corp., 400 F.2d 36 (6th Cir. 1968), *cert. denied,* 393 U.S. 1119 (1969) (hereafter *McLouth*).

The entire transcript and record in *McLouth*, briefs from both parties in the district court and in the court of appeals, the appendices in the court of appeals, the opinions from the district court and court of appeals, and the papers requesting and opposing certiorari in the Supreme Court were included in the record of the District Court for the Western District of Pennsylvania to aid in its consideration of the collateral estoppel issue. Appendix Vol. II, 1091-92.

3. In deciding this case, the district court wrote three opinions, entitled Opinion Summary—Collateral Estoppel (1-169); Opinion Compendium—Collateral Estoppel (1-446); and Opinion—The Jones & Laughlin Cases (1-127). The opinions are dated Jan. 29, 1974; each was amended Feb. 11, 1974; judgment was entered Feb. 19, 1974. References are to the typescripts, referred to respectively as Summary, Compendium, and Opinion.

A. The Parties and the Cause of Action

The patent in question,[4] referred to as the Suess patent, is the fundamental United States patent that teaches a process for producing steel by utilizing substantially pure oxygen to react with, and remove, impurities from molten pig iron. The "basic oxygen process," as it is commonly denominated, has been adopted by steel makers throughout the world as a material technological advance over previously available processes for manufacturing steel.

The three plaintiffs in this case control the Suess patent in the United States and indeed throughout the world. They are VOEST,[5] a steel manufacturing company operated by the government of Austria, which presently owns the patent; BOT,[6] a European corporation formed by VOEST, Brassert and others to be the exclusive licensing agent for a group of patents involving oxygen steel production; and Kaiser Industries, the exclusive United States licensee of BOT. The defendant, Jones & Laughlin Steel Corporation, is a major United States steel producer.

Two cases are before the Court: one for royalties, filed by Kaiser in 1961 against Jones & Laughlin for alleged breach of a licensing agreement to use the Suess process at a plant in Aliquippa, Pennsylvania; and another, filed in 1961 by all three plaintiffs, for alleged infringement of the Suess patent by Jones & Laughlin at an unlicensed oxygen steel production plant in Cleveland, Ohio.[6a] The actions were begun in the Northern District of Ohio and removed to the Western District of Pennsylvania. There they were consolidated and tried without a jury. Judgment was for the plaintiffs and defendants appealed.

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4. United States patent 2,800,631, issued July 23, 1957.

5. Vereinigte Oesterreichische Eisen-Und Stahlwerke Aktiengesellschaft (VOEST).

6. Brassert Oxygen Technik, A.G. (BOT). A third partner, OAM, Oesterreichisch-Alpine Montangesellschaft, is not directly involved in the present dispute.

6a. Jurisdiction is founded on 28 U.S.C. §§ 1332(a)(1), 2201, 2202, and 35 U.S.C. §§ 271, 281.

In light of our disposition of the over-arching issue of collateral estoppel, we need not address the other contentions presented, such as the patent's validity and the alleged infringement.

B. Steel Refining and the Advent of the Oxygen Process

Reducing steel making to its essentials, iron is converted into steel via a two-step transformation.[7] In the first stage of the operation, the oxides contained in the iron ores are removed and the ore is reduced to pig iron. This process, known as smelting, is performed in a blast furnace.

It is the second step of the steel making operation, refining, that forms the backdrop for this litigation. The pig iron includes various chemical impurities, such as phosphorus, carbon, silicon, manganese and sulphur. Refining is directed to lowering the amounts of the impurities in the pig iron to levels congruent with desirable steel qualities, while at the same time avoiding the introduction into the steel of additional impurities such as nitrogen or oxides.

Several methods have been employed in modern times for the conversion of pig iron into steel.[8] The most efficient technique presently available for refining steel is the basic

7. Instructive historical synopses of the steel making process may be found in the district court Compendium, 15-23, and in its Summary, 6-18. *Also see McLouth,* 257 F. Supp. at 377-80, 400 F.2d at 38-40.

8. First there was the Bessemer-Thomas process, developed in the 1850's, in which air is blown through a series of inlets or tuyeres in the bottom of a vessel containing molten pig iron. The contaminants selectively react with the oxygen that is in the air, and the impurities rise to the surface, to form a slag layer, or to go off into the air as carbon monoxide or carbon dioxide. Several limitations made the Bessemer-Thomas process far from ideal: nitrogen from the air was not excluded from the final steel product; excessive quantities of phosphorous or sulphur might remain; and complications entailed in the process made it costly and inefficient. Bessemer-Thomas refining has virtually disappeared from modern steel making.

The open hearth process, initially employed in the 1880's, uses a large furnace fired by oil or gas as the locus of refining. The open hearth method produced high calibre steel. Its drawbacks were the need for large amounts of capital, high operating costs, a slow refining rate, and a relatively low production capacity per furnace. The open hearth process dominated in steel manufacturing before the advent of the basic oxygen process, accounting for approximately 90% of steel production in the United States in the 1950's.

A third refining process, involving the electric furnace, is used very seldom for general commercial purposes because of its high production costs. *See* note 9, *infra.*

oxygen process, which jets a stream of high purity oxygen downward from above the surface of the molten metal bath. As practiced commercially, the advantages of the basic oxygen process are substantial. The resulting product is high quality steel, with low and controllable phosphorous and nitrogen content. And the steel can be rapidly manufactured in large batches, with relatively low capital and operating costs.

The remarkable success of the oxygen technique of steel refining is evidenced by the swift expansion of the industrial capacity for producing such steel. Most newly constructed facilities for the manufacture of steel adopt the basic oxygen method. The percentage of total steel produced by this process in the United States rose rapidly after the early 1960's, and by 1970 oxygen steel production accounted for more tons of raw steel produced in the United States than the open hearth process.[9]

Initial efforts to refine steel utilizing pure oxygen forcefully propelled from above the bath surface were patented in Germany in 1943 by Schwarz,[10] and in Belgium, Britain and France, shortly thereafter, by Miles.[11] However, the specific techniques taught by Schwarz and Miles were never exploited commercially.

Experiments in Austria in 1949 produced superior results under a modified version of prior oxygen steel making. The Austrian experiments were conducted under the aegis of VOEST, a plaintiff in this case. In contrast to the earlier schemes, that taught deep penetration of the oxygen stream into the bath, the Austrians employed an

9. These undisputed facts and statistics on steel making processes are derived from evidence submitted below, from the Opinion of the Western District Court, 25-26 (whose data sources are the 1967 Minerals Year Book, Bureau of Mines, U.S. Dept. of Interior, and a report by the American Iron & Steel Institute), and from the district court opinion in *McLouth*, 257 F. Supp. at 378-79.

10. German patent No. 735,196, issued July 3, 1943, granted to Schwarz' employer, H. A. Brassert & Co.

11. Belgian patent No. 468,316, issued November 30, 1946; British patent No. 642,084, issued August 30, 1950; French patent No. 983,096, issued April 9, 1948.

oxygen jet of more moderate force, so that the oxygen did not penetrate so deeply into the bath. Under the new process, the oxygen, hitting on the center surface of the bath, reacts with impurities in the area of impact. The oxidized manganese and phosphorous leave the bath and float up into the slag layer that is created. The carbon monoxide that is produced by the process, however, is believed to form minute explosive bubbles that are driven downward toward the bottom of the vessel. Great heat is generated by the exothermic reactions at the point of oxygen contact, and a thermally induced circulation occurs inside the bath. The general circulation pattern is described as downward in the bath center, and around and upward along the sides of the hemispheric vessel. Because of the circulation pattern, unreacted portions of the bath are constantly exposed to the oxygen reaction area. The locally evolved heat at the reaction center is dissipated and absorbed in secondary, endothermic reactions along the sides of the refractory vessel.

On occasion, various elements of the multi-faceted physical-chemical Suess process have been singled out as the essence of the invention. However, in order to distinguish the Schwarz and Miles patents that teach that oxygen should be blown deep into the molten metal bath, emphasis has been consistently placed on avoidance of deep penetration by the oxygen stream, and the chemical and physical effects that flow therefrom.[12]

C. Patenting the Suess Process

After developing the concept of an oxygen jet of moderate force, the Austrians proceeded to seek patent

12. 400 F.2d at 49: "Appellants [Kaiser et al.] have insisted throughout this case that they regard the subject matter of the patentees' invention to be 'avoidance of deep penetration.'" In their brief to the Sixth Circuit in *McLouth*, the same plaintiffs argued that the gist of the invention, avoidance of deep penetration, was the concept that the patentees intended to protect.

Plaintiffs have continued to acknowledge in the present case that avoidance of deep penetration by the oxygen jet is the critical nub of their invention. Plaintiffs' brief 8, 9, 13-14. *See also*, Suess continuation-in-part application, Nov. 1954, U.S. Patent Office; Drs. Hauttmann & Rinesch, affidavits, U.S. Patent Office.

protection. However, to avert conflict with the rather similar Schwarz patent, owned by Brassert, and in order profitably to commercialize the basic oxygen process, VOEST and Brassert in 1952 formed an exploiting firm, the plaintiff BOT. By agreement, BOT acquired exclusive rights to license oxygen steel making patents controlled by either of the partners. Pursuant to the plan of the parties, BOT licensed plaintiff Kaiser in 1954 as its sole licensee in the United States. Once the United States patent for the Suess process was secured, rights under the Austrian process thus accrued to Kaiser.[13]

The original filing for the United States patent that forms the basis for the present suit was by Suess, in 1951. Suess applied for the patent in his own name and designated himself as sole inventor. However, in 1955, VOEST succeeded to the world-wide patent rights of Suess, and both BOT and Kaiser thereby acquired a derivative interest in any United States patent that issued to VOEST on the basic oxygen process developed by Suess. A short time later, three Austrian co-workers of Suess, Drs. Trenkler, Rinesch and Hauttmann, were included in the patent application as co-inventors of the process.

The Suess application followed a labyrinthian course through the United States Patent Office, only a limited portion of which is relevant here. Ultimately, the 1951 claims and specification were definitively rejected by the Patent Office and abandoned by the plaintiffs.[14]

A continuation-in-part application covering the same invention was filed November 16, 1955. The specification of the continuation application contained a more particu-

13. In the course of this opinion, reference to Kaiser is intended to incorporate the other plaintiffs wherever appropriate.

14. 35 U.S.C. § 112 (1954) requires that a patent specification:

> contain a written description of the invention, and the manner and process of making and using it, in such full, clear, concise and exact terms as to enable any person skilled in the art to which it pertains . . . to make and use the same. . . .
>
> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

larized discussion of the procedures to be followed in practicing the basic oxygen method. It concluded with fifteen new claims, the first four advocating, as a critical element in the invention, the avoidance of deep penetration by the oxygen jet. All the new claims were rejected by the Patent Office on June 14, 1956, because the claimed invention was covered by prior patents, including the Miles patent and an early Brassert patent.[15] The patentees thereupon amended the application on December 7, 1956, cancelling claims 1 through 10, resubmitting claims 11 through 15 with only minor changes, and adding claim 16, incorporating the concept of avoidance of deep penetration. Documentation accompanying the modified submission distinguished the Miles patent "in the very important particular of depth of penetration" by the oxygen jet. It continued,

> [We are] emphasizing a much lower impingement pressure and a practically negligible penetration of the surface of the molten metal by the oxygen jet. As pointed out at length in the specification . . . it is of utmost importance . . . to avoid deep penetration of the molten metal by the oxygen or air blast.[16]

The claims were totally revised on June 11, 1957. The patentees advised the Patent Office: "The claims of the application are cancelled and new claims No. 17 and No. 18 are substituted therefor in view of the discussion with the [Patent Office] examiner on May 1, 1957. . . . The new claims are believed to be properly definitive of the invention."[17] The two new claims do not by their terms advert to the depth of penetration by the oxygen jet. However, accompanying the new claims were affidavits from two of

15. The Cuscoleca patent, U.S. No. 2,741,555, issued April 10, 1956, was also a basis for the Patent Office rejection of the continuation-in-part claims. Cuscoleca, also held by the plaintiffs, appears to have teachings quite similar to the Suess patent. Despite its having been filed subsequent to Suess, Cuscoleca issued earlier. Cuscoleca is not directly involved in the present litigation.

16. Plaintiffs' Exhibit 2-A, Patent Office File Wrapper of Suess patent.

17. *Id.*

the inventors, Drs. Rinesch and Hauttmann, that did discuss the question of oxygen penetration and expanded generally on the experimental and theoretical background of the basic oxygen process. No alterations were made in the specification when the new claims were filed.

On June 17, 1957, six days after the new claims were filed, and following a final conference with the Examiner that took place on June 14, 1957, one minor amendment was inserted in the first new claim. This amendment rendered the patent application acceptable to the Patent Office. As a result, the application was allowed on June 27, 1957, and the Suess patent was issued July 23, 1957.[18]

The specification in the patent that issued described a process whereby steel was refined by using a high speed jet of pure oxygen directed vertically downwards onto a bath of molten metal, through an early-formed slag layer, in a manner so as to *avoid deep penetration* of the metal bath by the oxygen. The patent claims did not mention the avoidance of deep penetration. Instead, the claims read as follows:

> 1. Method of refining molten impure iron in the presence of a slag in a vessel having a refractory lining by blowing with oxygen, which comprises discharging a stream of oxygen vertically downwardly through the slag layer onto and below the surface of the bath at the central portion thereof, to an extent to *avoid material agitation* of the bath by the oxygen stream, the contact of the oxygen with the bath resulting in reaction of the oxygen with a portion of the iron and with the oxidizable impurities of the bath in a localized reaction zone spaced a substantial distance from the refractory lining, the reactions in said zone resulting in refining of the iron and gas evolution and in the production of high temperature in the reaction zone away from the refractory lining, said reaction producing a circulatory

18. A more extended discussion of the proffered claims and their reception by the Patent Office may be found in *McLouth*, 400 F.2d at 52-55.

movement in the molten metal, which circulatory movement brings those portions of the molten metal bath which are remote from the reaction zone into the reaction zone whereby those portions are subjected to said reaction with minimum injury to the refractory lining.

2. The gaseous oxygen process set forth in claim 1 in which the oxygen is blown into said vessel under pressure in a range between about five and about twenty-five atmospheres above normal atmospheric pressure. (emphasis added).

D. Litigation Respecting the Suess Patent: The McLouth Case

Several years prior to the issuance of the Suess patent, McLouth Steel Corporation, a United States manufacturer, sent representatives to confer with the Austrians. McLouth resolved to integrate the new oxygen process in its facility then being developed. Accordingly, McLouth entered into a contract with Kaiser in November, 1954, under which Kaiser would give advice and assistance to McLouth.

1. *Proceedings in the Michigan District Court.*

After McLouth's oxygen steel-making plant was in production, Kaiser determined that McLouth was conducting an unlicensed infringing operation. Consequently Kaiser, together with VOEST and BOT, brought suit in the Eastern District of Michigan on July 19, 1957, four days before the Suess patent issued, claiming infringement of the Cuscoleca patent, which plaintiffs also control.[19] A subsequent amendment to the complaint substituted the Suess patent for the Cuscoleca patent.[20]

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19. *See* note 12, *supra*.

20. The Suess patent has been the subject of litigation practically from its date of issue. In Kaiser Industries Corp. v. Wheeling-Pittsburgh Steel Corp., 328 F. Supp. 365 (D. Del. 1971), reference is made to the existence of ten

McLouth admitted the use of the Austrian process, but predicated its defense on the assertion that, for a variety of reasons, Kaiser did not possess an enforceable patent. Among its contentions, McLouth attacked the Suess patent process as anticipated by prior art, specifically by the Schwarz and Miles patents,[21] and as obvious to one skilled in the art at the time of the invention.[22] McLouth also asserted that the patentees had not invented the process.[23] Additionally, McLouth urged invalidation of the Suess patent because of indefiniteness, alleging that neither the claims nor the specification of the Suess patent satisfied the statutory requirements embodied in 35 U.S.C. § 112, and contending that the specification did not support the claims of the Suess patent.

The district court proceedings in *McLouth* were prodigious, and characterized by the district court in that case as follows:

> The litigation has been unusually long and complex. After several years of pretrial research, experimentation and discovery, the case came to trial in October, 1963. Trial of the case required 150 days of court time, spread over an entire calendar year. More than 13,800 pages of testimony were taken, consisting largely of scientific evidence, much of which required the use of interpreters. A great number of exhibits were received in evidence, including large testing equipment, test pieces, and many demonstration movie films, as well as a considerable volume of documentary evidence. At the conclusion of the trial, briefs were

20. (Cont'd.)
suits—in addition to the *McLouth* and *Jones & Laughlin* cases—involving the Suess patent. At oral argument it was stated, without objection, that a number of the cases have been consolidated and that further proceedings have been stayed pending the determination of this case. At oral argument it was also indicated that unpaid royalties and damages for infringement under the Suess patent exceed one billion dollars.

21. Anticipation constitutes a patent defense under 35 U.S.C. § 102 (1954).

22. Obviousness constitutes a patent defense under 35 U.S.C. § 103 (1954).

23. Lack of inventorship constitutes a patent defense under 35 U.S.C. § 102(f) (1954).

> prepared and submitted by the parties, totaling nearly 1000 printed pages. Final arguments lasted five days. . . . The testimony and documentary exhibits in [bound] form occupy approximately [equal amounts] of library shelf space, totaling more than twelve feet.[24]

In addition to the evidence received in the form of expert testimony and documents, the Michigan district judge undertook a site visit to the McLouth plant. He also witnessed a series of experiments in a University of Michigan metallurgy laboratory.

The conclusions of the Michigan district court were announced in an opinion of 70 printed pages filed July 16, 1966.[25] The court accorded appropriate recognition to the statutory presumption of patent validity,[26] and to the heavy burden of proof on one who would overcome a patentee's rights under the Constitution and statutes. The basic oxygen process patented by Suess was determined to confer "substantial advantages [which] . . . quickly became apparent."[27] "The remarkable success of the [basic oxygen process was] dramatically illustrated"[28] by statistics relating to recent steel plant construction and annual capacities. The Michigan district court expressed the view that revolutionary patents such as Suess merit a liberal construction.[29]

Attacks on the patent's validity were addressed seriatim by the Michigan court. After a careful discussion, it found unpersuasive McLouth's contentions that the Suess patent was anticipated by prior art, was obvious, lacked inventorship, and that the specification did not satisfy the statute.

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24. 257 F. Supp. at 377, note.

25. *Supra* note 2.

26. 35 U.S.C. § 282 (1959). Trio Process Corp. v. L. Goldstein's Sons, Inc., 461 F.2d 66 (3d Cir.), *cert. denied* 409 U.S. 997 (1972).

27. 257 F. Supp. at 398.

28. *Id.* at 399.

29. *Id.* at 441-42. This Circuit adheres to the same rule of interpretation. Corning Glass Works, Inc. v. Anchor Hocking Glass Corp., 374 F.2d 473 (3d Cir. 1967), *cert. denied* 389 U.S. 826 (1967).

The Michigan court then turned to a consideration whether the *claims* of Suess satisfied section 112. Section 112 provides in pertinent part:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

In this regard the Michigan court determined that there were three statutory mandates that had not been met and that, therefore, the Suess patent was void for indefiniteness.

First, it ascertained that the claims of the patent do not properly measure the invention:

> [T]he avoidance of deep penetration is clearly the subject matter which applicants regarded as their invention, and yet the concept of the avoidance of deep penetration simply cannot be read into the claims of the patent in suit. The language of the claims admittedly does not refer expressly to the avoidance of deep penetration of the bath by the jet, nor can any language of the claims be construed to contain such a meaning.[30]

In response to the assertion, pressed vigorously by Kaiser, that the claim language, "avoid material agitation," incorporated the notion of avoidance of deep penetration, the Michigan court gave its reasons for being unable to find a causal relationship between the key terms "agitation" and "penetration." Undeniably, no causal relationship was defined within the four corners of the patent. In addition, as a logical proposition it appeared to the Michigan court "that even deep penetration would avoid material agitation as defined by plaintiffs."[31]

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30. *Id.* at 426 (reference omitted).

31. *Id.* at 426.

Supplementing the foregoing grounds of decision, the Michigan court found "a further reason why the actual invention of the patentees cannot be read into the claims of the patent in suit."[32] The Patent Office had earlier been presented with claims by Suess that expressly identified "avoidance of deep penetration" as an "essential feature" of the invention. These claims were rejected by the Patent Office and later cancelled by Suess. The Michigan court found that the applicant acquiesced in the Patent Office rejection of the claim, "the cancellation of which amounts to a disclaimer."[33]

The Michigan court held that the patentees were bound by their choice to submit an alternative description rather than to appeal the rejection. The conclusion of the Michigan court was based on Schriber-Schroth Co. v. Cleveland Trust Co., where the Supreme Court expounded the doctrine of file wrapper estoppel:

> It is a rule of patent construction consistently observed that a claim in a patent as allowed must be read and interpreted with reference to claims that have been cancelled or rejected and the claims allowed cannot by construction be read to cover what was thus eliminated from the patent. . . .[34]

The second issue under section 112 was whether the patent claims found support in the specification. The Michigan court applied the "well-established principle of patent law that the claims of a valid patent must be supported by the specification."[35] Here again, the Michigan court found the patent wanting, since several steps of the claims were not defined or described adequately in the specification.

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32. *Id.*

33. 257 F. Supp. at 427, quoting Schriber-Schroth, 311 U.S. 211, 220 (1940), and relying on Smith v. Magic City Kennel Club, Inc., 282 U.S. 784 (1931) and Leggett v. Avery, 101 U.S. 256 (1879).

34. 311 U.S. 211, 220-221 (1940).

35. 257 F. Supp. at 428. Schriber-Schroth Co. v. Cleveland Trust Co., 305 U.S. 47 (1938).

In particular, the Michigan court could discover no support in the specification for any reasonable interpretation of the claim language, "to avoid material agitation of the bath by the oxygen stream." The court undertook a careful review of relevant legal precedent, of the exact language of the claims and the specification of the patent, and of expert testimony. It painstakingly considered Kaiser's contention that the specification did in fact teach the subject of the claim.

However, the Michigan court concluded from the evidence that the notion of material agitation *by the oxygen* "is a fiction,"[36] because the violent chemical reactions taking place occasioned so much agitation that no effect from the oxygen was discernible. Furthermore, experts did not appear to understand what the claim language meant. While the language used in the specification, "avoidance of deep penetration," was perhaps a claimable invention, the court was unable to locate any teaching in the specification that would correlate the concept disclosed in the specification (avoidance of deep penetration) to the concept claimed (avoidance of material agitation). Nor, the Michigan court found, would such a relationship be apparent to those skilled in the art.

As an additional reason for not reading the specification to fulfill the language of the claim, the Michigan court again expressed its understanding that it was bound by the doctrine of file wrapper estoppel. Under the file wrapper doctrine, it held, the language that had been cancelled from a claim could not be reinserted in an allowed claim by the process of interpretation.

By a similar analysis, the Michigan court found no support in the specification for the claim language of a chemical "reaction producing a circulatory movement in the molten metal" or that the oxygen was to be blown "below the surface."

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36. 257 F. Supp. at 433.

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By a similar analysis, the Michigan court found no support in the specification for the claim language of a chemical "reaction producing a circulatory movement in the molten metal" or that the oxygen was to be blown "below the surface."

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36. 257 F. Supp. at 433.

There was yet another ground in *McLouth* for disallowing the patent claims under section 112. Contrary to the requirements of patent law, the Michigan court held, the claims are not restricted to the invention since they cover prior art. "[Because of the] broad scope of the claims, . . . even a person practicing the prior art would infringe the process of the claims."[37]

In capsule form, the Michigan court found the Suess patent invalid under section 112 on three independent grounds: the claims did not measure the invention, the claims were not supported by the specification, and the claims covered prior art. In the course of its opinion, the Michigan court mentioned that it was unfortunate that the patentees had not pursued more insistently their original claims, advocating avoidance of deep penetration, since such claims appeared more likely to form the basis of a valid patent.

2. *Proceedings in the Sixth Circuit.*

The judgment of invalidity based on the opinion by the Michigan court was appealed to the Sixth Circuit. The four points argued by Kaiser to the Sixth Circuit were (1) whether the doctrine of file wrapper estoppel precluded a construction of the Suess claims incorporating the concept of avoidance of deep penetration; (2) whether the claims defined the invention sufficiently to satisfy section 112; (3) whether the claims were adequately supported by the specification; and (4) whether the claims over-reached so as to cover prior art.[38]

As to the file wrapper estoppel, the sole contention pressed by Kaiser in the Sixth Circuit was that the Michigan district court had misconstrued the doctrine. Kaiser argued to the Sixth Circuit, "The doctrine of file wrapper estoppel has no application in those cases where nothing

37. *Id.* at 439. For this proposition the Michigan court cited cases including United Carbon Co. v. Binney & Smith Co., 317 U.S. 228 (1942); Huntman Stabilizer Corp. v. General Motors Corp., 144 F.2d 963 (3d Cir. 1944).

38. A cross-appeal was taken by McLouth on the issues of obviousness and inventorship.

has been surrendered by the applicant to get his patent or where, as here, there was a mere rephrasing of the claims in an effort to put them into more apt language. . . ."[39] Kaiser, asserting that avoidance of deep penetration was and always had been considered the gist of the patentee's invention, took the position that it had never abandoned this concept during the Patent Office proceedings. No argument was advanced that Kaiser was unaware that the file wrapper estoppel question would arise in the Michigan court, and was therefore deprived of an opportunity to present evidence on such issue.

The Sixth Circuit filed its opinion affirming the Michigan court on August 2, 1968. It expressly approved the manner in which the district court had conducted the trial:

> The handling of the protracted trial on infringement by the District Judge was a monumental task, which he performed ably and well. . . .[40]

Although it declined to embrace every determination by the trial court, the Sixth Circuit concluded that the Suess patent was invalid because the claims did not particularly and distinctly claim the invention described in the specification.[41] Further, the Sixth Circuit upheld the district court's conclusion that the language actually used in the claim—avoid material agitation—"had no meaning to one skilled in the art."[42] Finally, the Sixth Circuit held that the claim reached impermissibly beyond the invention, to encompass prior art. It viewed such a claim as an improper attempt to extend a patent monopoly, and stated that the remedy for such an attempt would be to invalidate the patent.[43]

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39. Kaiser, Brief on appeal to the Sixth Circuit in *McLouth*, at 26.

40. 400 F.2d 36, 38 (6th Cir. 1968).

41. United Carbon Co. v. Binney & Smith Co., 317 U.S. 228 (1942). *See infra* note 88.

42. 400 F.2d at 54.

43. Grave doubts were raised by the Sixth Circuit regarding the correctness of the district court's holding that the invention was not obvious. However, the case was not remanded for further findings on this point because of the ultimate holding of invalidity on other grounds.

Two members of the Sixth Circuit panel found that file wrapper estoppel would preclude a court from reading the phrase "avoid deep penetration" into the claim of the Suess patent. Relying on *Schriber-Schroth*[44] the majority held:

> We believe that sound inferences can be drawn from the Patent Office's rejections of earlier claims which contained the element of avoidance of deep penetration and its reference to the Cuscoleca Patent. Although the record is void as to the content of the discussion with the Examiner on May 1, 1957, we believe that an inference of abandonment can be drawn from the omission of 'avoidance of deep penetration' from the final claims. In our opinion, if the element was as important as the affidavits imply, it would have been explicitly included in the claims; the Patentees were well aware that our patent laws require that the claims 'distinctly' claim the alleged invention. The appellants cannot regain the phrase or qualify the effect of their acquiescence through the affidavits. Parke, Davis & Co. v. American Cyanamid Co., 207 F.2d 571, 574 (6th Cir. 1953). In the face of prior rejections, the claim allowed, cannot, by construction or affidavit, be read to cover that which was specifically abandoned by the patentee so as to give the allowed claim a scope it might have had without the omission of the language.[45]

With regard to the factual determination whether the patentees abandoned their claim of deep penetration, the court of appeals expressed the view that "abandonment is established if a phrase used in an abandoned or rejected claim is not used in a later accepted claim."[46]

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44. 311 U.S. at 220. Smith v. Magic City Kennel Club, Inc., 282 U.S. 784 (1931); Exhibit Supply Co. v. Ace Patents Corp., 315 U.S. 126 (1942).

45. 400 F.2d at 54.

46. *Id.* at 55.

The third judge on the Sixth Circuit panel joined the opinion in all respects except that portion dealing with file wrapper estoppel. His determination of patent invalidity was based flatly on the failure of the patentee's claims to satisfy the definiteness requirement of section 112.

A petition for certiorari posing, inter alia, the question whether the file wrapper estoppel issue was correctly decided, was denied by the Supreme Court March 3, 1969.[47]

E. Litigation Respecting the Suess Patent: Proceedings in the Western District Court.

After several years of pretrial proceedings, the trial of this case for contract royalties and patent infringement began in the District Court for the Western District of Pennsylvania, on October 23, 1967. It continued with some interruptions until its conclusion on March 14, 1968.

In the period between trial and decision the record in the Western District of Pennsylvania was twice re-opened. In September, 1969, the district court granted a motion by plaintiffs to open the record in order to submit evidence relating to file wrapper estoppel.[48] The following April, there was filed a deposition by the Patent Office Examiner who had been responsible for final approval of the Suess patent. Also, testimony was received from the patentees' attorney, who had been present at the May 1, 1957 interview at the Patent Office that had preceded the claim revision. The attorney testified that, consistent with Patent Office policy favoring positive formulations, the substitution of the claims just prior to issuance was intended to convey a

47. 393 U.S. 1119 (1969). In the petition for certiorari, Kaiser did not contend that it was foreclosed from an adequate opportunity to present evidence on the file wrapper estoppel point. Rather, it claimed the Sixth Circuit had erred as a matter of law as to the file wrapper estoppel.

48. This motion was presented to the court below eighteen months after trial had concluded, some three years after the district court decision in *McLouth*, over a year after the Sixth Circuit affirmance, and six months after the denial of certiorari in that case. The suggested reason for reopening the record was to fill an alleged "void" in the record of *McLouth*, *see* text at n.45, *supra*, since Kaiser wished to combat the inference of abandonment of its original claim language. The Western District Court noted, however, that it disputed the existence of such a void. Summary 120. Compendium 403.

more positive concept of localized penetration, in preference to the negative language, namely, "avoidance of deep penetration."[49] He alleged that there had been no intention to abandon the concept of avoidance of deep penetration, and that the change in words did not reflect an abandonment of the theory of the invention.

A second re-opening occurred the following year, in 1971, when *Blonder-Tongue*[50] was announced by a unanimous Supreme Court. As previously indicated, *Blonder-Tongue* decreed that the defendant in a patent infringement action may assert a plea of collateral estoppel based upon a final determination of patent invalidity in a prior infringement case brought by the patentee, even though the earlier suit was against a different party.

The watershed decision in *Blonder-Tongue* radically altered the posture of the present case, then pending before the Western District Court. It became incumbent on that court to ascertain the collateral estoppel effect of the *McLouth* determination. Additional hearings and argument were scheduled in September, 1971 regarding the import of *Blonder-Tongue* and the file wrapper estoppel issue. Witnesses included the former Commissioners of Patents and other experts in Patent Office practice.

Final argument was heard in December, 1971. In January, 1974, the Western District Court decided the case in three comprehensive opinions totaling nearly 800 pages.[51] These opinions are devoted in substantial measure to the collateral estoppel question. The Western District Court concluded that *Blonder-Tongue* did not require that it accept the defense of collateral estoppel in the situation presented. To assess the correctness of the determination of the Western District Court in this respect, it is necessary to examine in detail the rule announced in *Blonder-Tongue*.

49. As the Western District Court observed, it is somewhat difficult to perceive in what way the final claim language, "avoid material agitation," is more positive than the cancelled language, "avoid deep penetration." Compendium 66-67.

50. 402 U.S. 313 (1971).

51. *See* note 3 *supra*.

F. The Blonder-Tongue Decision.

In *Blonder-Tongue*[52] the Supreme Court partially overruled the holding of Triplett v. Lowell[53] and in the context of actions for patent infringement jettisoned the rule that "the estoppel of a judgment must be mutual."[54] The Court unanimously held that, where a patent had been declared invalid in a prior adjudication, an unrelated defendant in a subsequent action for infringement may assert a collateral estoppel defense based on the previous judgment.[55] In reaching its decision, the Supreme Court discussed at length the singular qualities of patents, and the special characteristics of patent litigation. The outcome was the creation of a pragmatic formula that harmonized considerations of due process and judicial economy. It was aimed at producing substantial justice while avoiding needlessly repetitious litigation.

The Supreme Court considered and rejected the notion that patents were per se so complex that a rule permitting infinite litigation of patent validity was required. Many of the issues involved in deciding questions of patent validity, it was stated, do not require any scientific training to

52. 402 U.S. 313 (1971). The mutuality doctrine had long been criticized; both state courts and lower federal courts had eliminated mutuality as a requisite for collateral estoppel in many nonpatent areas of law. *E.g.*, Bruszewski v. United States, 181 F.2d 419 (3d Cir. 1950), *cert. denied*, 340 U.S. 865 (1950); Zdanok v. Glidden Co., 327 F.2d 944 (2d Cir. 1964), *cert. denied* 377 U.S. 934 (1964); Bernhard v. Bank of America, 19 Cal. 2d 807, 122 P.2d 892 (1942).

53. 297 U.S. 638 (1936). An early case establishing the basic elements of collateral estoppel, that included mutuality, is Cromwell v. County of Sac, 94 U.S. 351 (1876).

54. Bigelow v. Old Dominion Copper Mining & Smelting Co., 225 U.S. 111, 127 (1912), quoted in *Blonder-Tongue*, 402 U.S. at 321.

55. A prior ruling could not ordinarily be asserted against a non-party, consistent with current understanding of due process. *E.g.*, Philips Electronic & Pharm. Ind. v. Thermal & Electronics Ind., 450 F.2d 1164 (3d Cir. 1971) (patentee cannot assert *Blonder-Tongue* estoppel where first adjudication results in finding of validity).

Critics have admonished the courts lest the collateral estoppel doctrine be expanded improvidently. Due process considerations must, they argue, prevail over the interests of judicial economy. *See*, Semmel, Collateral Estoppel, Mutuality and Joinder of Parties, 68 Colum. L. Rev. 1457 (1968); Currie, Civil Procedures: The Tempest Brews, 53 Calif. L. Rev. 25 (1965); Moore & Currie, Mutuality and Conclusiveness of Judgments, 35 Tul. L. Rev. 301 (1961).

resolve. Even in complicated patent cases, the Court noted, there is no reason to expect that further litigation will produce a better result than the initial determination.

In justifying use of the estoppel defense against a patentee by an unrelated defendant, the Court emphasized that the patentee in *Blonder-Tongue* had enjoyed both the initiative and incentive in the prior litigation. The patentee in *Blonder-Tongue* had been plaintiff in the first case,[56] and thus chose the party to sue and determined the time and place of the litigation. These elements are also found in the present case. The plaintiffs here, Kaiser, BOT and VOEST, took the initiative in *McLouth* and made the decision when and where to file suit.

Additionally, mindful of the deliberate nature of patent litigation, and the high stakes that can turn on a question of patent validity, the Supreme Court in *Blonder-Tongue* cautioned:

> Presumably [the patentee] was prepared to litigate and to litigate to the finish against the defendant there involved. . . . [T]here is no reason to suppose that plaintiff patentees would face either surprise or unusual difficulties in getting all relevant and probative evidence before the court in the first litigation.[57]

It cannot reasonably be maintained that there was a want of incentive for a vigorous litigation in the *McLouth* case. First, the action involved very substantial amounts of money. Second, even under the mutuality requirement of *Triplett*, there were potential collateral estoppel effects. The McLouth company itself, for instance, could open new steel plants that utilized a process covered by the Suess patent. In any infringement action brought by Kaiser regarding such subsequent plants, the parties and the issue of patent invalidity would be the same as in the first

56. University of Illinois Foundation v. Winegard Co., 271 F. Supp. 412 (S.D. Iowa 1967), *aff'd* 402 F.2d 125 (8th Cir. 1968), *cert. denied* 394 U.S. 917 (1969).

57. 402 U.S. at 332.

McLouth case. The holding of patent invalidity from the first *McLouth* case, therefore, would provide a successful collateral estoppel defense to *McLouth* in such later suits. Since nearly all new steel manufacturing installations were then adopting the basic oxygen process, this hypothesis is not unrealistic. We are therefore persuaded that Kaiser had adequate incentive to litigate fully in the *McLouth* case.

In the initial trial of the patent at issue in *Blonder-Tongue*, the plaintiff, having lost in the district court after a disposition on the merits, appealed to the court of appeals. That court affirmed and the plaintiff petitioned unsuccessfully for certiorari on the question of patent validity. This procedural history contributed to the Supreme Court's conclusion that the previous patent trial had been diligently pursued "to the finish." The litigation in *McLouth* followed a parallel course procedurally. And there can be no doubt that the *McLouth* litigation was also "to the finish."

Consequently, we conclude that, from the standpoint of initiative in bringing suit, incentive to litigate, and full exercise of appellate rights, *McLouth* is essentially identical with the original case reviewed in *Blonder-Tongue*.

However, even where a defense of collateral estoppel may be appropriately raised, the Supreme Court did not mandate its unqualified acceptance. Instead, under *Blonder-Tongue*, before collateral estoppel is determined, the patentee must be allowed "to demonstrate, if [it] can, that [it] did not have 'a fair opportunity procedurally, substantively and evidentially to pursue [its] claim the first time.' "[58]

Under the Supreme Court holding, the correctness of the result of the earlier patent suit is not at issue.[59] In-

58. 402 U.S. at 333, *quoting* Eisel v. Columbia Packing Co., 181 F. Supp. 298, 301 (D. Mass. 1960).

59. Blumcraft v. Kawneer Co., 482 F.2d 542 (5th Cir. 1973); Sampson v. Ampex Corp., 478 F.2d 339 (2d Cir. 1973); University of Illinois Found'n v. Blonder-Tongue Lab., Inc., 465 F.2d 380 (7th Cir. 1972), aff'g 334 F. Supp. 47 (N.D. Ill.). There is not unanimity on this matter, however. *See* 49 N.Y.U. L. Rev. 343 (1974).

deed, the sole ground explicitly recognized by the Supreme Court to defeat a motion for summary judgment made in the second case and premised on *Blonder-Tongue* is that the first adjudication did not provide a "full and fair opportunity to litigate."

The Supreme Court set forth criteria to guide the second trial court in its determination whether to reject the defense of collateral estoppel:

> Determining whether a patentee has had a full and fair chance to litigate the validity of his patent in an earlier case is of necessity not a simple matter. In addition to the considerations of choice of forum and incentive to litigate mentioned above, certain other factors immediately emerge. For example, if the issue is non-obviousness, appropriate inquiries would be whether the first validity determination purported to employ the standards announced in *Graham v. John Deere Co.*, [383 U.S. 1 (1966)]; whether the opinions filed by the District Court and the reviewing court, if any, indicate that the prior case was one of those relatively rare instances where the courts wholly failed to grasp the technical subject matter and issues in suit; and whether without fault of his own the patentee was deprived of crucial evidence or witnesses in the first litigation. But as so often is the case, no one set of facts, no one collection of words or phrases, will provide an automatic formula for proper rulings on estoppel pleas. In the end, decision will necessarily rest on the trial courts' sense of justice and equity.[60]

The guidelines suggested for reaching a result permitting relitigation are replete with qualifying words making a patentee's burden onerous. In effect, a patentee must persuade a second trial court "that the prior proceedings were seriously defective."[61]

60. 402 U.S. at 333-34 (citations omitted).

61. 402 U.S. at 333.

After enumerating particular factors, the Supreme Court stated that the decision whether to adopt the estoppel defense is entrusted finally to "the trial courts' sense of justice and equity." We do not interpret the phrase "justice and equity" to constitute a departure from the exacting language used by the Supreme Court earlier in the same paragraph of its opinion.[62] Rather, the phrase indicates that each case merits individual consideration before a district court rules on an estoppel plea and, possibly, that other extraordinary grounds, not expressly mentioned, may provide the necessary foundation for denying a collateral estoppel defense in individual cases.

It is suggested by Kaiser that generalized concepts of justice and equity constitute an independent ground for denying an estoppel defense, and that a determination whether such independent ground exists should rest in the discretion of the trial court. We cannot acquiesce to a meaning of the words "justice and equity" that would permit unarticulated and unreviewable determinations when a district court refuses a plea of collateral estoppel in patent litigation.

Courts have on several occasions been presented with particular factual circumstances that patentees contended justified relitigation on grounds of justice and equity. Most such situations could be comprehended under a broad interpretation of the concept of a full and fair opportunity to litigate the validity of a patent. For example, where appellate review has been foreclosed, parties have maintained that estoppel of judgment should be inoperative.[63] Patentees

62. *See* Blumcraft v. Kawneer Co., 482 F.2d 542 (5th Cir. 1973).

63. In Hall v. United States Fiber & Plastics Corp., 476 F.2d 418 (3d Cir. 1973), the district court had held that the patent was invalid and that the defendant had not infringed. An appeal was taken only on the question of validity, which the patentee claimed could be asserted against him subsequently under *Blonder-Tongue*. The Court dismissed the appeal as moot and held that the estoppel effect was a matter to be addressed in a later suit, citing Rest. Judgments, § 69(2) to the effect that foreclosure from appeal by reason of mootness deprives a judgment of its conclusive effect. *But see* Sampson v. Ampex Corp., 478 F.2d 339 (2d Cir. 1973) (estoppel granted although appeal not pursued).

have also objected to estoppel predicated on patent invalidity when the first trial procedure was unorthodox.[64] In the *Blumcraft* cases,[65] estoppel was unsuccessfully contested on grounds of justice and equity where two prior decisions had divided on the question of the patent validity. Attempts to elude estoppel based on considerations of justice and equity have, since the *Blonder-Tongue* decision, generally failed.[66]

The Western District Court reasoned that, since the law favors inventiveness, considerations of justice and equity made collateral estoppel inapplicable.[67] This observation, of course, would be equally apposite to every patent case, and would perforce eliminate substantially all collateral estoppel under the new *Blonder-Tongue* precept. The Western District's reliance on justice and equity would appear to overlook the significance of the prior judgment of invalidity. Its rationale is also at odds with the thrust of the Supreme Court discussion, emphasizing the paramount public interest in maintaining patent monopolies only where appropriate.[68]

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64. *But see* Carter-Wallace, Inc. v. United States, 496 F.2d 535 (Ct. Cl. 1974), according estoppel effect against a patentee, based on Carter-Wallace, Inc. v. Otte, 474 F.2d 529 (2d Cir. 1972), *cert. denied* 412 U.S. 929 (1973).

In *Otte*, because the defendant was trustee in a bankruptcy reorganization of the alleged infringer, it had no resources to present a full defense. Consequently, the defendant's case was presented by incorporation of testimony from a trial by the patentee against a different defendant.

65. Blumcraft v. Kawneer Co., 482 F.2d 542 (5th Cir. 1973) (patent invalid under *Blonder-Tongue*); Blumcraft v. Architectural Art Mfg. Co., 337 F. Supp. 853 (D. Kan.) *aff'd* 459 F.2d 482 (10th Cir. 1972) (patent invalid under *Blonder-Tongue*); Blumcraft v. United States, 372 F.2d 1014 (Ct. Cl. 1967) (patent valid); Blumcraft v. Citizens & Southern Ntl. Bank, 407 F.2d 557 (4th Cir.), *cert. denied* 395 U.S. 961 (1969) (patent invalid).

66. The isolated exception that has come to our attention, permitting relitigation of the issue of patent validity, is Grantham v. McGraw-Edison Co., 444 F.2d 210 (7th Cir. 1971). That case, decided within a week of *Blonder-Tongue*, presented a number of exceptional factors, including a change in patent ownership and a truncated earlier trial. *See also*, Berner v. British Cmwlth. Pacific Airlines, Ltd., 346 F.2d 532 (2d Cir. 1965), *cert. denied*, 382 U.S. 983 (1966) (non-patent; a multi-victim accident litigation).

67. Summary 168.

68. 402 U.S. at 343-46, and cases cited therein.

We thus are unable to support the Western District Court's basis for invoking principles of equity and justice. While it may be that some combination of circumstances based on independent equitable considerations might arise to warrant denial of estoppel, we perceive nothing on the facts here that would indicate such a result.

We also take cognizance that this Circuit has long been in the vanguard of an amplified application of collateral estoppel principles. In 1950, Judge Hastie anticipated *Blonder-Tongue* when in Bruszewski v. United States,[69] a non-patent case, he abandoned the mutuality requirement and held the plaintiff estopped from relitigating a liability issue he had tried and lost in a former case against a different defendant. Since then, the Third Circuit has "adopted a rather expanded view" regarding collateral estoppel[70] and, at least for defensive purposes, collateral estoppel may be asserted without mutuality "unless some overriding consideration of fairness to a litigant dictates a different result."[71]

G. Application of Blonder-Tongue *to the Present Case.*

The Western District Court decided that, in the present case, no collateral estoppel effect should be conferred on the former judgment.[72] The Michigan court in *McLouth*, it is recalled, had held the Suess patent to be invalid, and the Sixth Circuit affirmed. In brief, the *McLouth* courts had decided that the claims of the patent failed in several

69. 181 F.2d 419 (3d Cir.), *cert. denied*, 340 U.S. 865 (1950). In a protest against the *Triplett* doctrine in the patent field, Judge Hastie dissented in Nickerson v. Kutschera, 419 F.2d 983, 984 (3d Cir. 1969), on grounds of collateral estoppel.

70. Lynne Carol Fashions, Inc. v. Cranston Print Works Co., 453 F.2d 1177, 1181 (3d Cir. 1972).

71. Bruszewski v. United States, 181 F.2d at 421. Lynne Carol Fashions, *supra* note 70; Provident Tradesmens Bank & Trust Co. v. Lumbermens Mutual Casualty Co., 411 F.2d 88 (3d Cir. 1969); Scooper Dooper, Inc. v. Kraftco Corp., 494 F.2d 840 (3d Cir. 1974). Possible affirmative use of collateral estoppel against a losing defendant, a concept not at issue here, was suggested by the Court en banc in Katz v. Carte Blanche Corp., 496 F.2d 747 (3d Cir. 1974), *cert. denied* 43 U.S.L.W. 3213 (Oct. 15, 1974).

72. Opinion Summary 168.

respects to conform to the patent statute, and that the interpretation urged by the plaintiffs was legally impermissible by reason of the doctrine of file wrapper estoppel.[73] Thus, before the Western District Court could appropriately reject collateral estoppel in the present case, it had to find that each of these two bases of decision was unreliable under the *Blonder-Tongue* guidelines.[74]

In considering the issue of collateral estoppel, the Western District Court undertook an extensive investigation of the *McLouth* case. It re-examined not only the opinions but the entire record and briefs of *McLouth* with minute attention to detail. The Western District extended its study beyond the record of *McLouth* and consulted outside authorities to aid its understanding. The method of analysis pursued by it was to advance point by point through the *McLouth* opinions and, at each juncture, to provide the reader with a critique of the support in the record on which the Michigan court and Sixth Circuit opinions rely.[75]

The Western District Court, purporting to employ the criteria of *Blonder-Tongue*, first ascertained that the matter before it was indeed "one of those relatively rare

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73. The Sixth Circuit discussion is in 400 F.2d, *supra*, at 49-53.

74. Kaiser argues that where a decision is premised on more than one ground, neither ground carries any collateral estoppel effect. In support, Kaiser refers to Halpern v. Schwartz, 426 F.2d 102 (2d Cir. 1970). In *Halpern*, an earlier case had voided a transfer in bankruptcy, based on three independent grounds. One ground was that the transfer was "intentional." One of the parties attempted to assert the collateral estoppel effect of the finding that the transfer was intentional. The Second Circuit declined to permit this effort, ruling that the isolated word formed but a part of one of three separate grounds of decision. The court reasoned that it would be improper to assume that "intentional" was used with the requisite consideration for collateral estoppel to apply.

By contrast, in the case here, all the grounds of the very core of the first decision, that is, the invalidity of the Suess patent, are urged for collateral estoppel purposes, and it is beyond question that the entire *McLouth* determination was accompanied by a carefully considered and plenary review. No suggestion was made in *Blonder-Tongue* that a holding of patent invalidity predicated on several grounds was entitled to less collateral estoppel weight than a patent held invalid for but one reason.

75. *See*, for example, the Western District Court's consideration of the *McLouth* discussion of "Onto and below the surface" at Summary 46-47 and Compendium 175-187, and its analysis of the *McLouth* result regarding "Material agitation" at Summary 48-55 and Compendium 188-212.

instances where the courts wholly failed to grasp the technical subject matter and issues in suit."[76] In particular, it stated that the trial court in *McLouth* "wholly failed to grasp" the "true invention" of the patentees,[77] namely, the separation of the reactions into two chemical components: a heat generating (exothermic) portion and a heat absorbing (endothermic) portion.

Moreover, the Western District Court found that, by concentrating excessively on the concept of "avoidance of deep penetration" and emphasizing the mechanical, physical aspects of the process to the exclusion of the chemical phenomena, the Michigan court had reached a totally fallacious conception of the invention.[78] Affirmance of the Michigan court by the Sixth Circuit, the Western District Court maintained, was based upon the same misconception of the invention.[79] Once it resolved that the *McLouth* courts wholly failed to grasp the scientific process at issue, the Western District accordingly found that no estoppel effect attached to the *McLouth* determination that the claim language of the Suess patent did not satisfy the requirements of section 112.

In order to overcome the estoppel effects of *McLouth* entirely, the Western District Court was also forced to call into question the second basis for the holding in *McLouth*, that file wrapper estoppel foreclosed the interpretation of the Suess patent urged by Kaiser. On this matter, the Western District stated that the Michigan court had raised the issue of file wrapper estoppel *sua sponte*.[80] The Western District reasoned, therefore, that under the *Blonder-*

76. 402 U.S. at 333.

77. Summary 148.

78. Summary 148-154; Compendium 67-68.

79. Summary 113, 136.

80. It is not the case that the Michigan District Court raised the file wrapper estoppel issue for the first time in its opinion. Earlier, at final trial argument in *McLouth*, the Michigan District Court specifically confronted the Kaiser attorney with the possibility of a file wrapper estoppel. The response was a brief denial by Kaiser's counsel of the applicability of the doctrine to the pending case. No request was made at that time by Kaiser to reopen the record for submission of evidence or briefs.

Tongue guidelines, Kaiser had been prevented, without fault of its own, from presenting evidence on the crucial issue whether the language "avoid deep penetration" had been abandoned by the patentees. After receiving evidence on the question of file wrapper preclusion, the Western District was persuaded that no abandonment of the patentable concept, avoidance of deep penetration, had in fact occurred during the Patent Office proceedings. Consequently, it held that the language appearing in the Suess claims could be read to include the patentable invention which the Western District Court found was described in the specification.

For these two reasons, the Western District determined that the ***McLouth*** decisions provided no estoppel defense, and it was thereby free to draw its own conclusions regarding patentability and file wrapper estoppel from the evidence before it. The Western District Court thereupon held that the Suess patent was valid, and that the defendant had infringed it. Judgment was granted for plaintiffs.

We are asked to review, as a matter of law, whether the Western District Court properly interpreted and applied the ***Blonder-Tongue*** standards regarding collateral estoppel.

1. Alleged Deprivation of Crucial Evidence.

Although there is some dispute about the admissibility and probity of such evidence as Kaiser produced in the Western District Court,[81] we accept *arguendo* Kaiser's as-

81. Jones & Laughlin contends that the proper application of the file wrapper estoppel doctrine permits consideration only of the written documents in the Patent Office file. It urges that no testimony may properly be adduced regarding the contents of discussions between the patent examiner and the patentee. A close reading of the Sixth Circuit opinion, quoted *supra* at n.45, 400 F.2d at 54, may substantiate this theory. The Sixth Circuit noted a "void" in the *McLouth* trial record respecting the reasons for the eleventh hour substitution of claim language. However, this lack was apparently not critical to the Sixth Circuit, which inferred abandonment because earlier claims of "avoid deep penetration" had been rejected under prior art. Because we determine that collateral estoppel precludes further litigation on the file wrapper question, the scope of inquiry in file wrapper estoppel disputes is not an issue the Court must address.

sertion that such evidence was admissible and helpful to it. Nonetheless, we cannot agree that the absence of this evidence in *McLouth* vitiates the collateral estoppel effect of the earlier determination. In *McLouth*, claims Kaiser, inadequate evidence was presented to resolve the question whether Kaiser in fact abandoned its concept of "avoid deep penetration" by removing that language from the claim and inserting the phrase, "avoid material agitation." Since this matter was raised *sua sponte* by the Michigan court after the evidence was closed, Kaiser contends, it was thereby deprived of an opportunity to present testimony disproving the conclusion reached by the Michigan court.

We have carefully studied the relevant papers in *McLouth*, including the trial and appellate briefs and opinions, regarding the issue of file wrapper estoppel. In the course of examination it has been helpful to refer to the *McLouth* record. We have considered the Supreme Court cases that are relied on in the Sixth Circuit as the framework for the latter court's holding on file wrapper estoppel.[82] And we have reviewed carefully the opinion of the district court in this case.[83]

In order to show that a prior judgment is not binding for want of essential evidence, a patentee must fulfill the two criteria of the Supreme Court test. It must persuade the second court that the additional evidence was crucial to a proper resolution in the first tribunal, and that the patentee bore no responsibility for the absence of the evidence in the prior trial. Kaiser has not shown either element.

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82. Schriber-Schroth Co. v. Cleveland Trust Co., 311 U.S. 205 (1940); Exhibit Supply Co. v. Ace Patents Corp., 315 U.S. 126 (1942); Smith v. Magic City Kennel Club, Inc., 282 U.S. 784 (1931). *See* Trio Process Corp. v. L. Goldstein's Sons, Inc., 461 F.2d 66 (3d Cir.), *cert. denied*, 409 U.S. 997 (1972).

83. This Court expresses no views on the correctness of the holdings in *McLouth*—either by the district or appeals court—pertaining to the file wrapper estoppel issue. *See* note 59, *supra*.

First, since the Michigan court invalidated the Suess patent on independent grounds of indefiniteness under section 112, the file wrapper estoppel evidence may be described as "crucial" only if the indefiniteness ground of decision fails. However, for purposes of collateral estoppel, we must accept the *McLouth* invalidation of the Suess patent based on the inadequacy of the claims under section 112, unless the Michigan court did not comprehend the case or, specifically, that issue. We do not find the Michigan decision so infirm.[83a] Hence, the file wrapper evidence is not crucial.

Second, even assuming the file wrapper evidence is crucial, we are also unable to hold that Kaiser was blameless as to the lack of evidence regarding this issue. On appeal to the Sixth Circuit, Kaiser had the opportunity to complain about the matter of reliance, *sua sponte*, by the Michigan court on file wrapper estoppel. Kaiser chose to dispute neither the procedural manner in which the file wrapper issue was raised by the Michigan court, nor the fact that Kaiser was not given an opportunity at the trial to present evidence on file wrapper estoppel. Instead, Kaiser in the Sixth Circuit relied on the legal argument that no file wrapper estoppel should obtain where "nothing has been surrendered . . . there was a mere rephrasing of the claims,"[84] and where affidavits accompanying the new claims explained the new terminology. The Sixth Circuit majority rejected Kaiser's contentions regarding the legal effect of the patentee's actions on the Patent Office.

Now Kaiser assumes a different posture and raises objections to the *McLouth* proceeding that are bottomed, not on the legal aspects of file wrapper estoppel, but rather on the foreclosure of evidence. In the absence of a compelling reason why it could not have raised this objection at the time of the *McLouth* appeal, Kaiser is not at liberty to voice such a protest here.

83a. *See* notes 88-93, *infra*, and accompanying text.

84. Kaiser, Brief to Sixth Circuit in *McLouth*, 26.

The reasons advanced for the evidentiary omission in the *McLouth* case do not excuse Kaiser for its failure to raise the subject of the file wrapper estoppel evidence.[85] The Western District Court stated that Kaiser did not argue the evidentiary point in *McLouth* because Kaiser relied on the Sixth Circuit to reverse the Michigan court as a matter of law. But this tactical determination hardly constitutes an event in which Kaiser is without fault.

It is also suggested that Kaiser's motivation to litigate was reduced because, at the time Kaiser was on trial in *McLouth*, the rule of *Triplett* was the law and therefore the scope of loss as to Kaiser was limited. We have noted above that the consequences to plaintiffs of a defendant victory in *McLouth* were sufficiently grave to provoke a vigorous prosecution of that case, even in the absence of the *Blonder-Tongue* rule.[86] No additional reasons have been urged to excuse Kaiser's failure to raise the matter on appeal in *McLouth*, nor can the Court discern any.

Thus, the *McLouth* proceedings do not disclose that Kaiser's right to a fair and full opportunity to litigate the issue of file wrapper estoppel was diminished to any degree by an inability to present crucial evidence without fault of its own. Accordingly, the Western District Court erred in receiving and considering evidence on the substantive issue of file wrapper estoppel,[87] and its judgment on file wrapper estoppel cannot be sustained.

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85. Compendium 61-62.

86. *See supra* 27-28. It is not significant that the earlier holding of invalidity preceded the *Blonder-Tongue* decision. *Blonder-Tongue* on remand, 334 F. Supp. 47 (N.D. Ill. 1971), aff'd 465 F.2d 381 (7th Cir. 1972), *cert. denied* 409 U.S. 1061 (1972). *Technograph* family, *infra* note 96; *Blumcraft* family, *supra* note 65.

87. The Supreme Court indicated that the record in *Blonder-Tongue* might be supplemented on remand "with any evidence showing why an estoppel should not be imposed in this case." 402 U.S. at 350. Under such a directive, the only evidence that could appropriately be admitted in this case would be information bearing on Kaiser's decision not to appeal to the Sixth Circuit the manner in which the Michigan court raised the file wrapper issue.

2. *Alleged Failure by* McLouth *Courts to Grasp the Subject Matter and Issues.*

We next focus on the determination by the Western District Court that the *McLouth* courts "wholly failed to grasp" the scientific nature of the patented process and, consequently, that their judgments are not entitled to collateral estoppel value. We have painstakingly read the *McLouth* opinions and briefs, in concert with the claims and specification of the Suess patent. In addition, we have studied the case law on which the *McLouth* courts relied in finding the patent invalid for indefiniteness under 35 U.S.C. § 112.[88] Our review has included a careful evaluation of the Opinion, Summary and Compendium of the Western District Court.

Unlike the Western District Court, we are led to the unequivocal conclusion that the *McLouth* tribunals did not "wholly [fail] to grasp the technical subject matter and issues in suit" in deciding the validity of the Suess patent. The documentary evidence refutes the possibility that the *McLouth* courts were so misguided.[89]

A substantial number of factors contribute to our conviction. Judge Freeman, the district judge in *McLouth*, allocated an unusual amount of time to the trial, and devoted considerable effort to understanding the underly-

88. *See e.g.*, the following cases cited by the Sixth Circuit: Halliburton Oil Well Cementing Co. v. Walker, 329 U.S. 1, 13 (1946) ("a patentee cannot obtain greater coverage by failing to describe [its] invention than by describing it as the statute commands"); United Carbon Co. v. Binney & Smith Co., 317 U.S. 228 (1942) (indefinite claims do not give notice of the invention that is required by Congress); Thabet Mfg. Co. v. Kool Vent Metal Awning Corp., 226 F.2d 207 (6th Cir. 1955) (patentee is bound by definition of phrase suggested to, and accepted by, the Patent Office).

The following additional cases were cited by the Michigan District Court: General Electric Co. v. Wabash Appliance Corp., 304 U.S. 364 (1938) (the claims measure the invention; they must inform the public of the limits of the invention); Schriber-Schroth Co. v. Cleveland Trust Co., 305 U.S. 47 (1938) (claims cannot claim more than the specification discloses).

89. *See* Wahl v. Vibranetics, 474 F.2d 971 (6th Cir. 1973), where the Court of Appeals affirmed a grant of summary judgment for defendants based on collateral estoppel over protests that the earlier trial court had misunderstood the case and that crucial evidence was unavailable at the first trial. *See also* cases cited in notes 65, 96.

ing industrial and scientific principles. He was alert to the contentions of the parties and "keenly aware of the issues for decision."[90] This is evidenced by Judge Freeman's reading of voluminous documents, his presence at experiments scheduled for his edification, and his close attention to questioning at trial, all recited in his opinion. Moreover, the judge himself conducted intelligent questioning of counsel and expert witnesses during the trial and arguments.[91]

The Michigan court produced a comprehensive and comprehensible opinion, where extensive evidence was marshalled in an orderly and readily-digested fashion. A description of general steelmaking procedures was followed by a detailed discussion of the basic oxygen method. The exposition of the oxygen process revealed that the writer possessed a sure understanding of what occurred, chemically as well as physically, during the basic oxygen process. Finally, the Michigan court undertook a meticulous legal analysis of the requirements of definiteness under Section 112.

It would be unseemly to claim that the Michigan court did not understand the theories of the parties or ignored the evidence before it. Throughout the opinion, it supported its findings with extensive citations to the record. Indeed, the gist of the invention as found by the Michigan court, and affirmed on appeal, was precisely the definition advanced by the plaintiffs.

On appeal, no contention was heard that the Michigan court had misdefined or misunderstood the plaintiffs' invention. The facts found at trial were accepted without quarrel. Kaiser's contention on appeal was primarily a legal one, namely, that, when read properly, the claims and specification of the patent satisfied section 112. In *Blonder-Tongue*, the Supreme Court expressed special concern about patent litigation encrusted with rarified scientific

90. *Id.* at 975.

91. *See, e.g.*, 257 F. Supp. at 387, 394-95, 405, 425, 430, 433, 439.

concepts that have at times baffled judges untrained in the sciences.[92] But it appears that the questions presented to the Sixth Circuit involved essentially the meaning of reasonably non-technical language, and whether plain words in documents fulfilled the statutory mandate. Judges are uniquely well-qualified to resolve such questions.

On balance, the *McLouth* opinions are internally consistent, creditable analyses that appear compatible both with the language of the patent at issue and the principles of controlling law.

Other cases interpreting the *Blonder-Tongue* doctrine have required a most stringent standard for demonstrating failure of scientific comprehension.[93] In *Blonder-Tongue* on remand the district court responded to plaintiffs' argument that the initial trial court had not understood the technical issues by stating that, "It would demand arrogance to so conclude. . . . [The goals of *Blonder-Tongue*] cannot be achieved if mere disagreement in the second court supervenes the defense."[94] The Second Circuit has held that collateral estoppel will operate unless the first trial court has committed "an egregious error" involving a "blatant misunderstanding."[95]

Based on our consideration of *McLouth*, and without expressly endorsing the determination in *McLouth*, we hold that this case is not one of the rare exceptions enumerated in *Blonder-Tongue* where estoppel may be avoided because the courts in the earlier case did not fathom the process disclosed in the patent.

3. The Scope of Review.

It is necessary to comment on the scope of review undertaken by the Western District in reaching its conclu-

92. 402 U.S. 331-32, and cases cited therein.

93. No case has come to our attention holding that estoppel was inappropriate because of a failure of comprehension in the first trial.

94. 334 F. Supp. 47, 50 (N.D. Ill. 1971), *aff'd per curiam* 465 F.2d 381 (7th Cir.), *cert. denied* 409 U.S. 1061 (1972).

95. Sampson v. Ampex Corp., 478 F.2d 339 (2d Cir. 1973).

sions. Such review should be confined to as narrow a scope as is consonant with assuring a full and fair opportunity to litigate in the prior case. More probing review would be contrary to the purpose of the *Blonder-Tongue* rule. Unfortunately, no bright line emerges to distinguish between the review that *Blonder-Tongue* requires, and the unsparing scrutiny that would eviscerate the *Blonder-Tongue* doctrine.[96] Yet, guide posts have been erected.

District courts obliged to rule on *Blonder-Tongue* estoppel motions have, as we have here, reviewed certain pertinent data relating to the first trial for the general purpose of establishing that a full and fair opportunity to litigate was offered. They have considered, for example, whether the matter was tried, or whether it terminated by summary judgment, consent, or other settlement. Beyond examining the amplitude of the opinions, courts have also taken note of the length of trial, the pages of testimony, the number of witnesses and the exhibits.[97] A reading of the opinions, briefs, docket sheets, and other documents of record frequently suffices to resolve any doubts regarding a full opportunity to litigate.[98]

In Sampson v. Ampex Corp.,[99] in order to ascertain whether estoppel would be appropriate, the Second Circuit

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96. For a discussion of this problem, *see* Smith, The Collateral Estoppel Effect of a Prior Judgment of Patent Invalidity: *Blonder-Tongue* Revisited, 55 J.P.O.S. 285, 363, 436 (1973).

97. *Blumcraft* family of cases, *supra* note 65. Technograph Printed Circuit cases, all predicating estoppel on Technograph Printed Circuit, Ltd. [TPC] v. Bendix Aviation Corp., 218 F. Supp. 1 (D. Md. 1963), *aff'd per curiam*, 327 F.2d 497 (4th Cir. 1964), *cert. denied* 379 U.S. 826 (1964); TPC v. United States, 484 F.2d 1831 (Ct. Cl. 1973); TPC v. Methode Electronics, Inc., 484 F.2d 905 (7th Cir. 1973); TPC v. Martin-Marietta Corp., 474 F.2d 798 (4th Cir. 1973).

See also the factors discussed in United States v. Air Lines, Inc., 216 F. Supp. 709, 725-30 (E.D. Wash. 1962), *aff'd sub nom.* United Air Lines, Inc. v. Wiener, 335 F.2d 379, 404-05 (9th Cir. 1963), *cert. dismissed*, 379 U.S. 951 (negligence case).

98. Where a particular claim of deprivation of crucial evidence is raised, some analysis of the record to garner the relevant procedural facts may be required.

99. 478 F.2d 339 (2d Cir. 1973).

undertook a review of the voluminous record of the earlier trial. Judgment at the earlier trial had been adverse to the patentee, but because the parties had reached a settlement after trial no appeal had been prosecuted. The Second Circuit circumscribed its interest in the record most carefully, insisting that it did not re-assess the merits of the trial:

> Rather, we have examined the merits in the [earlier] case only to satisfy ourselves that decision was not based on such a blatant misunderstanding of the relevant legal principles as to make application of the estoppel doctrine inequitable.[100]

The Supreme Court in *Blonder-Tongue* indicated that, where the opinions exhibit an utter lack of comprehension by the initial judges,[101] a patentee might secure a second trial of the patent's validity. While examination may legitimately encompass more than the face of the opinions, the Supreme Court strongly suggested that when a court is asked to investigate the competence of an earlier trial court, its function is strictly limited. In practice, subsequent courts have inspected the record to observe whether the first judge appeared to exhibit an understanding of the matter during the proceedings. It has been found helpful, although not indispensable, to search the record of the former case to substantiate or refute an argument relating to an estoppel defense. In Wahl v. Vibranetics, Inc., the Sixth Circuit examined the record of an earlier case to discover whether the first judge had understood the scientific basis of the patent.[102] It concluded that no failure to comprehend the subject matter was demonstrated because the record disclosed that the district court was "keenly aware" of the issues for decision and the contentions of the parties.

100. *Id.* at 342-43.

101. 402 U.S. at 333.

102. 474 F.2d 971 (6th Cir. 1973). Technograph Printed Circuits, Ltd. v. Martin-Marietta Corp., 474 F.2d 798 (4th Cir. 1973).

The judge had participated, as Judge Freeman did in the Michigan case, in questioning witnesses; and he engaged in discussions with counsel regarding proposed findings of fact, revealing a working knowledge of the subject.

In determining whether the *McLouth* courts had the necessary scientific command of the basic oxygen process, the Western District Court conducted an extraordinary, wide-ranging scrutiny of the first trial. It concluded that in order to know whether the *McLouth* courts understood the basic oxygen process, it was necessary (a) to conduct independent evaluations of the experiments that the Michigan Court viewed;[103] (b) to reinterpret the testimony and the credibility of expert witnesses in *McLouth;*[104] (c) to resort to outside authorities for an understanding of the scientific information presented in *McLouth;*[105] (d) to weigh testimony; and (e) to interpret certain documentary evidence.[106]

Positions taken by counsel for plaintiffs in *McLouth* were reconstrued, and reasons were given to excuse binding the plaintiffs to the manner in which they conducted the trial.[107] Guided by hindsight, the Western District dissected the findings of the *McLouth* trial and reached its own conclusions because "the prior District Court found as best it could from the mass of evidence and exhibits, most of which could not be detailedly and fully examined, . . . while I on the other hand was not so hampered."[108]

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103. *E.g.*, Summary 59-63, 95, 154. Compendium 15.

104. *E.g.*, Summary 67-80, 92, 95, 154.

105. *E.g.*, Summary 78-79. Compendium 12, 201-02.

106. *E.g.*, Summary 153.

107. *E.g.*, Summary 91; 92 ("I, by hindsight, now realize that counsel for the plaintiffs might have pointed to much in the specifications for answers to the district court's questioning. . . ."); 94, 95-96 (". . . plaintiffs' counsel . . . put on a 'selling campaign' to the district court of 'reduced impact pressure of the jet on the bath so as to avoid deep penetration' and . . . he in very great likelihood oversold the feature at the trial"); 162 ("I considered the submissively respectful attitude of plaintiff's counsel . . ." and "plaintiff's counsel said the gist or the primary difference between the prior art process and [Suess] was that 'you avoid deep penetration'"); 163 ("overemphasis [by counsel] is a common fault").

108. Summary 79. Compendium 14-15.

Although *Blonder-Tongue* endorses a review of the prior trial by the district court judge in a subsequent case, it does not authorize unbridled excursions into the record of the earlier trial before applying the estoppel of the previous judgment. We have concluded that the Western District Court did not confine its inquiries to proper bounds, namely, whether the Michigan court displayed an understanding of the issues presented, adequately considered the evidence, and came to conclusions not altogether in disregard of the relevant technology, the evidence presented, and the governing principles of law. In deciding that the *McLouth* courts did not have an adequate command of the scientific subject, the Western District Court considered evidence not properly before it and delved impermissibly into the merits of the earlier case. Such procedure results in a substantial misallocation of judicial resources and undermines the very purposes of *Blonder-Tongue.*

H. Conclusion.

In fashioning the rule of *Blonder-Tongue,* Justice White for a unanimous Court made it clear that a determination of patent invalidity, after a thorough and equitable judicial inquiry, creates a collateral estoppel barrier to further litigation to enforce that patent. The *Blonder-Tongue* result advances the salutary goals of avoiding commercial intimidation based on patents that have once been declared invalid, and of conserving limited judicial resources. At the same time, fairness to litigants, both patentees and others, is preserved.

The case before us presents a situation quite akin to that in *Blonder-Tongue.* No exceptional circumstances have been suggested that would warrant a result here contrary to that reached in the *Blonder-Tongue* case. Indeed, arriving at such an adverse conclusion would, in effect, dismantle the beneficient effects of the Supreme Court rule.

Since the district court erred in its determination that the *McLouth* decision erected no collateral estoppel bar to the present litigation, we reverse its determination. An order will be entered directing the district court to grant judgment for the defendant based on collateral estoppel.

A True Copy:

Teste:

Clerk of the United States Court of Appeals for the Third Circuit.

(A.O.—U. S. Courts, International Printing Co., Phila., Pa.)

Before: ADAMS, GIBBONS and WEIS, *Circuit Judges*

[Entered April 4, 1975]

Judgment

This cause came on to be heard on the record from the United States District Court for the Western District of Pennsylvania and was argued by counsel.

On consideration whereof, it is now here ordered and adjudged by this Court that the judgment of the said District Court, entered February 19, 1974, be, and the same is hereby reversed, and the said District Court is directed to grant judgment for the defendant based on collateral estoppel, in accordance with the opinion of this Court. Costs taxed in favor of appellant.

ATTEST:

THOMAS F. QUINN
Clerk

OPINION OF THE DISTRICT COURT

IN THE UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF PENNSYLVANIA

Civil Action No. 61-551

KAISER INDUSTRIES CORPORATION, *Plaintiff*

v.

JONES & LAUGHLIN STEEL CORPORATION, *Defendant*

Civil Action No. 62-272

KAISER INDUSTRIES CORPORATION,
VEREINIGTE OESTERREICHISCHE EISEN-UND
STAHLWERKE AKTIENGESELLSCHAFT, and
BRASSERT OXYGEN TECHNIK, A.G., *Plaintiffs*

v.

JONES & LAUGHLIN STEEL CORPORATION, *Defendant*

[Decided January 29, 1974]

ROSENBERG, *District Judge*

OPINION SUMMARY—COLLATERAL ESTOPPEL

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Opinion Summary—Collateral Estoppel

This opinion summary is the finalization of the entire opinion required of me in these cases. But for many reasons, one of which is my hope that clarification of and a greater facility for understanding of the highly technical subject matter and its issues can best be achieved, I shall term the opinion itself "Compendium" to which references are made in this opinion summary directly to details. The compendium opinion is actually the report of my inquiry into the opinions of the prior District Court and the Court of Appeals in an identical patent subject-matter case before them, and as such contains my study, analysis, discussions, record references, authorities, my conclusions, and my specific findings of fact and conclusions of law as directed by Federal Rule of Civil Procedure 52.

The trial of the issues raised in these two consolidated patent actions, on oxygen application for the conversion of iron into steel, had been completed when the plaintiffs filed their "Motion to Reopen the Record" on June 16, 1969, and to allow them to produce additional evidence. This was occasioned by reason of the *sua sponte finding* by the prior District Court that file wrapper estoppel was applicable against the plaintiffs' right to pursue their action in that proceeding

[2] At the first post trial hearing the plaintiffs produced the evidence by way of a deposition of Claude A. LeRoy, Primary Examiner, who stated that the interviews before him were occasioned because of the wording of the claims; that everyone knew that prior art penetrated the oxygen jet deeply into the molten bath, but that the purpose of the applicants was to differentiate from prior art and to create a surface oxygen contact where the recognized reaction zone would occur; that the Patent Office did not like negative words and that the words upon which they agreed of "discharging a stream of oxygen vertically

downwardly through the slag layer onto and below the surface of the bath at the central portion thereof" was to be "to an extent to avoid material agitation of the bath by the oxygen stream".[1] This evidence was corroborated by the attorney who prosecuted the continuation-in-part application. The defendant presented no witnesses of its own. However, the defendant objected to admission of this into evidence as being immaterial, and subsequently in a brief, it raised the additional objection that the evidence violated the parol evidence rule. I admitted **[3]** the evidence over the objection and for the reason that if the patent was to be considered as a contract that the evidence did not attempt to vary, alter or contradict the contract, but that rather it attempted to explain the meanings of the terms contained therein.

Later on May 20, 1971 the defendant filed a "Motion for Leave to File a Plea of Estoppel" in accordance with the latest rulings of the Supreme Court on patent prosecutions in *Blonder-Tongue Laboratories, Inc.* v. *University of Illinoris Foundation et al.*, 402 U.S. 313 (1971). Prior to *Blonder-Tongue, Triplett* v. *Lowell*, 297 U.S. 638 (1936) permitted unlimited prosecutions by patentees against any number of defendants whereever they might be found. The Supreme Court in *Blonder-Tongue*, in correcting the evils under *Triplett*, denied a patentee a second choice against any other defendant where he was unable successfully to establish a right of action in the first action.

The Supreme Court speaking through Mr. Justice White, however, recognized the possibility that there could be some cases, where without fault on the part of the plaintiff, the court of courts "wholly failed to grasp the technical subject and issues in suit". *Blonder-Tongue* v. *University Foundation, supra*, at page 333. It therefore, placed the obligation of making **[4]** a determination on the subsequent trial

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[1] PX1, col. 12, lines 12-16.

judge on whether an estoppel plea in the subsequent patent trial on the identical issues should apply. It reminded that "In the end, decision will necessarily rest on the trial courts' sense of justice and equity." It stated that it would thereafter be "insufficient in and of itself to justify patentees relitigating validity issues as long as new defendants are available. This is especially true if the court in the second litigation must decide in a principled way whether or not it is just and equitable to allow the plea of estoppel in the case before it." *Blonder-Tongue, supra,* at page 334.

Certain rules were there laid down for the guidance of subsequent courts in cases which might arise. Thus, the Supreme Court not only modified the highly unjust practice of previous multifarious actions by a patentee after suffering a defeat but it also protected any patentee where justice and equity required that it be done.

In the second post-trial hearing the plaintiffs presented evidence through one of their experts of the [5] trial court's failure to comprehend the scientific testimony presented by him. They also presented evidence of a former patent commissioner and patent office practitioners regarding patent office procedure and customs. The defendant presented no witnesses but relied on a series of exhibits such as pretrial stipulations, letters between individuals, newsletters and arguments in briefs of the parties and certain pleadings in the prior McLouth case, including the final judgment on July 19, 1966 holding the Suess patent invalid. These exhibits present primarily matters of dispute and much that is immaterial to the issues permitted by *Blonder-Tongue.* Only the final judgment in McLouth had any credible value and I gave it full consideration.

Thus it was that these two pleadings, actually pretrial matters, were presented and heard post trial, due to the circustances which brought them about.

[6]

Iron Background

Early man first became acquainted with iron masses when they were hurled from the sky as meteorites. He quickly learned that these were capable of providing certain uses which were not available in the softer free metals, such as copper and gold, that had been at his disposal in prior times. Soon after he learned that certain soil when fired by the charcoal obtained from wood provided him with similar hard substances. He had earlier learned that the heated chunks of metals were malleable and could be shaped and even hardened by hammering.

The advantage of the manufacture of iron from iron ore came from the time in the year 2000 B.C. in India by the construction of the first blast furnace. The blast furnace was used by advanced people everywhere until sometime in the 19th century. It is reported that the hills of Pennsylvania, where iron ore and the abundance of trees were available, were dotted with blast furnaces. In England, the blast furnace use became so prevelant that at one time it was feared that the country would suffer deforestration because the timber was so lavishly used in feeding the blast furnace fires. It was then that the iron makers found that coal could be converted into [7] coke so as to produce a high enough temperature as with charcoal from the wood of the forest previously. Thus, the initial essentials were conducted of having carbon from coke, iron from iron ore and oxygen from the air in an oxidation process of converting the ore into impure iron. As time progressed its purification was given another lift when Bessemer invented his converter which contained a series of tuyeres or pipe-like inlets in the bottom of a kettle-like apparatus and through which air could be blown at a high velocity into and through the molten metal in the vessel. This brought about a higher temperature and a greater oxidation of the oxidizable elements of the iron. This and its equivalent vessel, the

Thomas converter in Europe were much in use and produced a quality of steel for many purposes. The big fault with these converters was that there was no way of preventing the nitrogen from the air becoming a chemical part of the finished product.

Then came the Siemens-Martin furnace, or open-hearth as it is better known, in the 1870's or 1880's. This consisted of a rectangular room-shaped furnace or a series of such furnaces in which the molten metal was poured and in which high [8] temperatures were generated by means of liquid or gas hydrocarbon fuels. The heat created in these was so intense as to cause the molten metal to actually boil much in the same way as water is made to boil on a kitchen range. By means of the open-hearth furnace the highest quality steel was produced and even the character and quality of the steel could be controlled to produce the finished product for special uses. And yet while the open-hearth had the capability of such production, it had a disadvantage too and that was that originally it took eleven to twelve hours to oxidize the crude blast iron into quality steel. A little later some steelmakers duplexed the Bessemer method with the open-hearth and shortened the time period. And still later, as we shall see, new ways were introduced to speed up the oxidation process so that eventually the finished steel could be made in a matter of hours.

In the meantime there were users of the electric [9] furnace which was capable of producing steel with a special carbon content valuable in the production of tools and such other products, but it had the disadvantage of requiring expensive electricity to generate high temperatures which the oxidation process required. While the Bessemer and Thomas converters were blowing air through the bottom tuyeres, there were some steelmakers who attempted in the latter part of the 19th century to blow whole air onto the surface of the bath but failed to produced any beneficial results.

[10] A scientific achievement occurred in 1898 which was bound to help the steel industry when Dr. Carl Linde discovered a method of extracting oxygen from the air. Before that oxygen, used primarily in laboratories, was manufactured by means of eletrolysis which separated water into its oxygen and hydrogen parts. With Dr. Linde's discovery, oxygen began to be looked upon for possible properties in aiding the steel industry; and in the 1920's it was evident [2] that the United States Department of the Interior reported on its possible use in improving blast furnace uses. However, when in 1928 Fraenkl (sometimes referred to as Frankl) came up with his method of producing oxygen from air on a tonnage basis, interested parties began to give it more attention. The Linde-Fraenkl Company in Germany established a plant for the production of oxygen and several other plants sprang up in Europe. These stored the oxygen in bottles, as was done before, and transported them to places where they were to be used. The United States during the war built portable oxygen plants for use by its military in other parts of the world. In Weirton, West Virginia in 1946, the Weirton Steel Company established a plant for limited uses. Mostly the oxygen was used in steel plants in [11] torches for cutting purposes. But steelmen both in Europe and the United States began to look at it as an agency for improving steel production.

In Europe the Linde-Fraenkl process was applied to extracting nitrogen from the air for fertilizer purposes and the oxygen became its by-product. In fact on one occasion a furnace was built at Suddeutsche Kalkstickstoff Werke, Trostberg, in Eastern Barvaria, for use in blast furnaces but it was abandoned. Dr. Durrer and Dr. Hellbruegge went to Trostberg to work on a large low shaft oxygen furnace.[3] Efforts were made to enrich the air blown in Besse-

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[2] Compendium I, page 18.

[3] Compendium XVII.

mer-Thomas Converters, but the increased temperatures were destructive of the tuyeres, and this was abandoned.

It remained for one Dr. Carl Schwarz, who was connected with H. A. Brassert & Co., a German steelworks, to apply for a patent in Germany on the process of blowing onto the surface of the molten metal bath at "such a high kinetic energy that it is capable of penetrating in the manner of a solid body deep into the bath." (Emphasis added)[4]. Schwarz gave very few instructions on how this was to be done but did indicate that the oxygen enriched air or oxygen itself was to be used and that its **[12]** introduction into the bath would bring about the high temperature required for oxidation away from the refractory walls and thus save them from destruction. The allowance of the patent was made known on April 8, 1943. However, not only was the process not utilized by the Brassert Company but no great rush of steelmen was recorded to adopt the use for what Schwarz declared was his invention.

In 1946, John Miles & Partners (London), Limited, applied for and was granted a patent in Belgium. Miles, recognizing the great loss of oxygen which occurred in attempting to inject it into the molten metal, now advocated that it be done by the use of an "oxidizing fluid at such speed that a sufficient proportion of the fluid penetrates into the metal..."[5] The fluid was to contain no more than 30% nitrogen. The instructions given by Miles were fuller than those given by Schwarz and even expressed the resulting effect of the injected oxygen into the bath by saying "The penetration of the jet also fulfills the useful function of agitating the bath so that the reactions take place uniformly and to the maximum extent."[6] This thinking was restated as follows "The jet serves to maintain a vigorous

[4] DX5A, page 2, lines 6-8.

[5] DX10A, page 2, lines 6-8; Compendium I, pages 34-35.

[6] Id. page 4, lines 4-6; Compendium I, page 34.

agitation so that the oxidizing reactions follow one another in the interior of the bath . . .''[7] The jet serves to circulate and agitate the metal and slag . . .''[8]

[13] Still the steelmakers did not come running to see and believe what John Miles had asserted was his patent. Neither is there any evidence that John Miles & Partners had adopted the process. In fact during this period of time, more than thirty steelmen and more unnamed steelmen were active generally in the field of application of oxygen to metallurgy.[9] The most pronounced of these experimenters were Dr. Robert Durrer and Dr. Heinrich Hellbruegge, experts with the Von Roll Steel Works in Gerlafingen, Switzerland, who in 1948 commenced a series of experimentations on the teachings of Schwarz, but did not come up with any resolution of the unsolved problems that that process presented.

During that time the Austrian Government decided to re-establish the steel plants which had been destroyed by the Allies during the war. It faced the question of heavy investment in re-establishing the open-hearth furnaces or of finding something more modern. It was familiar with the experiments which were going on at Gerlafingen. Accordingly, it sent Dr. Trenkler to Gerlafingen to observe the Durrer-Hellbruegge experiments. Dr. Trenkler knew only that they were practicing the deep penetration by the oxygen jet into the molten bath as advocated **[14]** by Schwarz, but learned nothing more from his visit, except perhaps in receiving advice from Dr. Durrer. Dr. Durrer asserted that he believed in the oxygen application process to steel and advised Dr. Trenkler to continue the "experiments". The Austrians accepted the advice and established a 3-ton converter at Linz to experiment on the Schwarz process. In

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[7] Id. page 10, lines 5-7; Compendium I, page 34.

[8] Id. page 18, lines 8-9; Compendium I, page 33.

[9] Compendium XVII.

the interim, four steelmakers in Europe who were experimenting with the use of oxygen agreed that they would mutually share their discoveries and permit all to use them. The patent rights were discussed and some agreements were had but not definitely.

On June 3, 1949, the Austrian experimenters, Dr. Theodor Suess, Dr. Herbert Trenkler, Dr. Hubert Hauttmann and Dr. Rudolf Rinesch [10] made their first test, and while blowing deeply suffered the loss of the use of the nozzle. On the same day, they started the next test, but this time the surround which contained the water to cool the oxygen nozzle, broke high up on the nozzle length and sprayed water on the surface of the molten bath. Although this was an accident, it resulted in producing better steel than the Austrians expected. This accidential occurrence and its result made them curious and they began to wonder whether or not the deep penetration of the prior art was really a neccessity in the oxygen application to the iron bath surface. They determined to test this theory by two different series of tests.

[15] Starting June 17th, in the first series of tests, they blew the oxygen deeply and received the same results as in Gerlafingen. Commencing with the June 25th series of tests, they changed the nozzle from a Laval type to a normal type and raised it from 10 centimeters above the surface to 15 centimeters above the surface. Although at that time the results of the product took about a week to determine, they learned that the June 25th series of tests resulted in a better quality of steel than that produced in the June 17th tests. Thereafter they carried out a series of tests on this new concept in various converters and in various ways until they had arrived at their conclusion by the end of the 250th test in November, 1950, that they had the process for making industrial steel. With this conclusion, the deter-

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[10] Compendium I, pages 21-22.

mination was to made to establish both the conversion vessel and an oxygen plant to produce the oxygen necessary in the process.

On December 14, 1949[11] Dr. Durrer who evidently was in touch with the situation, in a memorandum stated:

> "'The good results consist in particular in the very low contents of carbon, phosphorus and sulfur *which contradicts all metallurgical expectations. This work shows a new metallurgy with which we must first of all become acquainted.* Presumably, the extensive removal of these substances is due to the higher temperature, the higher degree of liquidity connected therewith and the higher reaction velocity resulting therefrom.' " (Emphasis added)

On May 5, 1950[12] Dr. Durrer in a congratulatory letter to [16] the Austrians said:

> "... my most sincere congratulations on this important metallurgical progress.",

and stated that he had not expected them to be able to solve this problem so quickly, but that he was nevertheless delighted after he had seen "the beautiful results" with his own eyes. He said also,

> "Now that the problem has been solved in principle, it is only a question in the further test of details, of polishing up the process, so to speak * * *."

With the establishment of two plants by the Austrian Government, one at Linz and one at Donawitz, word soon got around among steelmakers, and since I cannot improve on what the McLouth District Court said in this regard, I quote the following:

> "The quality of the steel produced was comparable to open hearth steel, while capital and operating costs

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[11] DX89B(20), 257 F.Supp. at page 417; Compendium I, page 38.

[12] DX89B(22), 257 F.Supp. at page 418; Compendium I, page 38.

were considerably reduced. Therefore, steelmakers from all over the world came to Linz to familiarize themselves with the new Linz process. (PX343, p.12). The reaction of the steelmakers to the Linz process was one of initial skepticism followed by recognition of the invention and adoption of the process." (257 F. Supp. at page 398)

McLouth from Michigan was one of these who sent its Mr. Lindberg to Austria and agreed thereafter to pay $100,000 for know-how relating to the Linz process; but its skepticism was not entirely abated because it spent large sums of money to [17] construct duplexing equipment in case the Linz process proved unsatisfactory. This it did because it was expanding its plant. However, the L-D process quickly proved to be highly satisfactory and it tore down its duplexing equipment. Subsequently, McLouth disavowed the L-D process and maintained that it was practicing the prior Schwarz patent process.

Another of these was the defendant in the instant actions, Jones & Laughlin, who also paid $100,000 for know-how and license rights for its Aliquippa plant, and afterwards disavowed its obligations to the Austrians and their United States licensee, and asserted that it, too, was practicing the prior Schwarz patent process. Jones & Laughlin also built a plant at Cleveland, Ohio and installed the same process there. The consideration of these matters is specially detailed in a separate opinion. Upon the disavowal by McLouth and eventually by Jones & Laughlin, actions were instituted against these respectively and in separate jurisdictions.

In the action in the United States District Court for the Eastern District of Michigan, McLouth raised the standard defense in a patent case of invalidity and non-infringement, but specifically that the Suess patent was anticipated by the prior art of Schwarz and Miles, that the process patent was obvious, that the plaintiffs were not

the inventors, but that Dr. Durrer and [18] Dr. Hellbruegge were, and that neither the specification nor the claims complied with the requirements of 35 U.S.C. §112 relating to definiteness. It additionally charged antitrust violations.[13]

The District Court Holdings

The District Court held that it was a "revolutionary" invention, "an outstanding invention";[14] that steelmakers from all over the world came to Linz to familiarize themselves with the process and that they came as skeptics and went away as believers and adopters of the process;[15] that the Austrians were the true inventors of the subject matter of the patent in suit;[16] that the Suess patent was neither disclose nor anticipated by the prior art and was therefore nonobvious to them,[17] except that a "localized reaction zone spaced a substantial distance from the refractory lining as set forth in the patent claim was anticipated by Schwarz and Miles, and as such obvious to persons skilled in the art;[18] and that following failures prior to 1949, "the enthusiastic reaction of industry to the invention after a period of initial skepticism, all clearly indicate that the invention by the patentees, the Linz process, was not obvious to persons skilled in the art.[19]

The District Court placed it on the points of anticipation [19] and non-obviousness and took opposite sides on the one theory that the invention was a physical discovery

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[13] 257 F.Supp. at page 386.

[14] 257 F.Supp. at pages 441-442.

[15] 257 F.Supp. at page 398.

[16] 257 F.Supp. at page 418.

[17] 257 F.Supp. at page 406.

[18] 257 F.Supp. at page 404.

[19] 257 F.Supp. at page 406.

as against the other side that the prior art of Schwarz and Miles had already discovered the chemistry reaction.

In response, then, to charges, objections and defenses raised by McLouth the District Court found in favor of the specification that it was not indefinite[20]; that the phrase "avoidance of deep penetration" "is certainly not a fiction"[21]; that the indefiniteness of the term "localized reaction zone"[22] nor "the inadequacy of the teaching of the specification",[23] nor down in center circulation even if nonexistent,[24] nor the unproved charge of inadequate disclosure of an appropriate nozzle,[25] nor the too indefinite degree of the "high temperatures" in the localized reaction zone,[26] nor any other charges of indefiniteness[27] impaired the ability of persons skilled in the art to make and use the invention on the basis of the disclosure in the specification, because the invention was disclosed in sufficiently clear terms to enable steelmakers "to make and use the same".[28]

As related to the wording contained in the claims under **[20]** Section 112, the District Court held that the plaintiffs took the position that "avoidance of deep penetration was the gist of the invention" because such a position was essential to rebut the defenses of anticipation, obviousness and non-inventorship[29]; that avoidance of deep pene-

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[20] 257 F.Supp. at page 422.

[21] 257 F.Supp. at page 422.

[22] 257 F.Supp. at page 423.

[23] 257 F.Supp. at page 423.

[24] 257 F.Supp. at page 423.

[25] 257 F.Supp. at page 423.

[26] 257 F.Supp. at pages 423-424.

[27] 257 F.Supp. at page 424.

[28] 257 F.Supp. at page 424.

[29] 257 F.Supp. at pages 425-426.

tration is clearly the subject matter of the applicants' invention and yet it could not be read into the claims of the patent[30]; that the wording in the claims of discharging a stream of oxygen through the slag layer "onto and below the surface of the bath" is not restricted to a non-deep penetration and would include penetration far below the surface of the bath[31]; that the language of "avoidance of material agitation of the bath by the oxygen stream" and "a localized reaction zone spaced a substantial distance from the refractory lining" are not causally related[32]; that the term "localized reaction zone spaced a substantial distance from the refractory lining" could also exist with deep penetration as taught by Schwarz and Miles[33]; that such language as avoidance of material agitation is not supported by any "antecedent language" in the specification[34]; and that because Claims 1 through 4 of the continuation-in-part application expressly *mentioned* the **[21]** avoidance of deep penetration as an essential feature of the claims and were rejected and later cancelled by the applicants, such cancellation amounted to a file wrapper estoppel against the use of such words, even if the applicants had used them in the specification.

Thereafter the District Court discussed and made findings of other matters; the Rinesch and Hauttmann affidavits filed with the continuation-in-part application would not help "persons skilled in the art of steelmaking at the time the invention was made" because such persons would not be responsible for knowing the contents of affidavits filed more than seven years later[35]; and that the term "avoid-

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[30] 257 F.Supp. at page 426.

[31] 257 F.Supp. at page 426.

[32] 257 F.Supp. at pages 426 and 430.

[33] 257 F.Supp .at page 426.

[34] 257 F.Supp. at page 429.

[35] 257 F.Supp. at pages 431-432; Compendium X, page 211.

ance of material agitation of the bath by the oxygen stream" was only supported by the specification "in a very limited and meaningless way" and could not have been a meaningful concept to persons skilled in the art at the time the invention was made.[36]

The District Court stated that there was "tangible evidence" in the record tending to confirm that the concept of material agitation by the oxygen stream is a fiction.[37] Thereafter [22] it discussed particularly two demonstrations, No. 7 and No. 9, made in the presence of the Court at the Cast Metal Laboratories of the University of Michigan at Ann Arbor; whereupon it made its findings of fact and discredited two of the plaintiffs' expert witnesses from the Massachusetts Institute of Technology, Dr. Shapiro and Dr. Elliott, as the District Court related such testimony with avoidance of material agitation and avoidance of deep penetration.

Dr. Shapiro had testified that chemical force-power resulting from the jet's impingement was 3000-8000 times stronger than the force-power of the jet itself. Accordingly, the District Court stated:

> ". . . as compared with the relatively feeble agitating power of the jet, it seems impossible that a deep penetration by the jet could overcome or even materially affect such circulation, so as to cause a material agitation by the oxygen stream."

It then made a number of findings on Demonstration No. 7 and No. 9.

> Demonstration No. 9 discredited Dr. Elliott's contradictory testimony of deep penetration being 35%-40% of the bath in Demonstration No. 9 and later testified that the penetration in Demonstration No. 9

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[36] 257 F.Supp. at pages 431-432; Compendium X, page 189.

[37] 257 F.Supp. at page 433; Compendium X, page 189.

was no more than 1.5 inches of a 6.8 inch bath depth, or approximately 22 percent of the bath depth.[38]

[23] Since Demonstration No. 7 strongly suggests material agitation by the oxygen stream is a fiction, then even under the process taught by Schwartz and Miles, chemical reactions rather than the mechanical action of the jet must have been the actual cause of agitation in the bath.[39]

The claim of circulatory movement in the molten metal produced by chemical reactions in a localized reaction zone is simply not supported by the teachings of the specification of the patent in suit.[40]

The references in the specification do not teach "in so many words" that circulation of the bath is produced by chemical reactions, as claimed.[41]

The plaintiffs' claim of reaction-induced circulation which could only be caused by chemical reactions, "is not the teaching of the specification.[42]

Because the specification teaches only a down in center circulation, the claim which is not limited to any direction of circulation clearly overclaims the specification.[43]

[24] "An 'explosive bubble' mechanism" would tend to justify a conclusion "that reaction-induced circulation in a molten metal bath could only be down in the center" was advanced by two of plaintiffs' expert wit-

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[38] 257 F.Supp. at page 435; Compendium XIII, pages 242-243.

[39] 257 F.Supp. at page 435.

[40] 257 F.Supp. at page 436.

[41] 257 F.Supp. at page 437.

[42] 257 F.Supp. at page 437.

[43] 257 F.Supp. at page 438.

nesses but was admittedly not contained in any literature prior to the time of trial."[44]

The plaintiffs engaged in "tortured construction of the specification and claims in the patent in suit in order to find support in the specification for a claim of reaction-induced circulation", when they could have clarified this by a sentence or two in the specification.[45]

The term "blowing onto and below the surface" does not support the plaintiffs' contention of a "practically negligible" penetration of the surface of the molten metal by the oxygen jet because "blowing onto and below" the surface is taught by the Schwarz and Miles patent.[46]

The applicants, when faced with rejection of their claims of "what they regarded [25] to be their invention as unpatentable over the prior art, they unwisely abandoned such claims and instead substituted new claims which were accepted by the Patent Office [and] the new claims failed to point out the actual invention of the patentees."[47]

The claims of the patent do not measure the invention of the applicants or accurately define or correctly describe what the applicants invented; and further, do not clearly distinguish what was claimed before in the art.[48]

Accordingly, they do not meet the requirements of 35 U.S.C § 112, and the patent in suit must be held invalid.[49]

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[44] 257 F.Supp. at page 438.

[45] 257 F.Supp. at page 438.

[46] 257 F.Supp. at page 439.

[47] 257 F.Supp. at page 440.

[48] 257 F.Supp. at page 441.

[49] 257 F.Supp. at page 441.

The Suess et al. patent failed "to particularly point out and distinctly claim the subject matter which the applicants regarded as their invention" and as such did not comply with the requirements of 35 U.S.C. § 112.[50]

[26] *The Court of Appeals' Review*

The United States Court of Appeals for the Sixth Circuit, on appeal, agreed with the District Court only on its determination that the Suess patent was invalid [51] and disagreed with it for the most part in all other respects. However, it discussed the reasons why it disagreed with the District Court primarily for these reasons:

The District Court's conclusion of non-obviousness was based entirely upon secondary considerations.

The Court of Appeals was not given a complete determination of the difference between the patent in suit and the prior art, or any findings concerning the level of skill in the pertinent art.

One of the most pertinent prior art patents, the Schwarz patent, was neither recited to nor considered by the United States Patent Office.

Other than the Gerlafingen experiments, the record does not disclose any extensive attempts and failures to refine steel by deep blowing of oxygen between 1946 and 1949.

The success of the Suess patent is made unclear because of arrangements for an exchange as to know-how and engineering knowledge between the various competitors.

[27] The District Court held that the only *difference* between the Suess disclosure and the prior art was

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[50] 257 F.Supp. at page 442.

[51] A dissent by Judge Edwards of the panel without an opinion was recorded.

the teaching of "avoidance of deep penetration" as opposed to "deep penetration".

The District Court failed to concisely define the difference between the depth of penetration taught by Suess and the limitation of the depth of penetration clearly defined by Schwarz and Miles.

The Suess patent does not distinguish "avoidance of deep penetration" from the prior art, presumably because it becomes almost impossible to do so.

Because the plaintiffs "have insisted throughout this case that they regard the subject matter of the patentees' invention to be 'avoidance of deep penetration'," which is not contained in the claim and their attempt to incorporate that reference in other language cannot "be interpreted as limiting the penetration of the oxygen stream to a 'practically negligible' penetration."

By the patentees assuming inconsistent positioning before the Patent Office, the patentees failed to define their alleged advantage over the prior art and they attempted to extend their monopoly to something already patented.

[28] In the face of the prior claim references by the patent office, inferences of abandonment can be drawn from the omission of "avoidance of deep penetration" in the claim and the patentees cannot regain the phrase to qualify the effect of their acquiescense through the affidavits because of the file wrapper estoppel.

Since avoidance of deep penentration is *clearly the subject matter* which applicants regarded as their invention, such "avoidance of deep penetration simply cannot be read into the claims of the patent."

The claims speaking of discharging a stream of oxygen vertically downwardly through the slag layer onto and below the surface of the bath at the central portion

thereof . . . is clearly not restricted to a non-deep penetration and could include penentration far below the surface of the bath."

The language of "avoidance of material agitation of the bath by the oxygen stream" and "a localized reaction zone spaced a substantial distance from the refractory lining" are not causally related to "avoidance of deep penetration."

[29] The term "localized reaction zone spaced a substantial distance from the refractory lining" could also exist with deep penetration as taught by Schwarz and Miles.

The term "substantial distance" is not given any definite meaning by the patent.

Claims 1 through 4 of the continuation-in-part application expressly *mentioned* the avoidance of deep penetration as an essential feature of the claim and were rejected and later cancelled by the applicants. Such cancellation in the file wrapper history estops the plaintiffs from reading into their invention the subject matter of "avoidance of deep penetration."

[30] With the condensed versions of the prior courts' opinions before us, it should be easier to pinpoint the report of my inquiry into an analysis of each. My inquiry into these was directed primarily as such are supported by the Suess patent specification and claims in relationship to the prior art Schwarz and Miles patents. And secondly, to the evidence presented in the case. If the Suess patent had a right to validity, it must have been on the basis of its own words. If clarifications were in order, such clarifications could only have been permitted by virtue of applicable patent law.

In holding that the Suess patent was nonobvious and unanticipated, the District Court's theory was that "the specification teaches a circulation brought about by the jet"

and that no reference in the specification teaches "in so many words" that circulation of the bath is produced by chemical reactions.[52] From this the District Court concluded that,

> ". . . plaintiffs are forced to engage in tortured construction of the specification and claims in the patent in suit in order to find support in the specification for a claim of reaction-induced circulation." (257 F.Supp. at page 438).

The Suess specification contains a series of instructions on the character of the vessel to be used, the ratio of the bath [31] depth to bath surface, the nozzle with a specified diameter per ton of charge, the spacing of the nozzle within prescribed limits above the surface of the molten metal bath, the outfitting of the nozzle with high purity oxygen, the directing of the nozzle vertically or nearly vertically at the surface of the bath, the placing of the nozzle centrally to the bath, and in so operating that the area of jet impingement is controlled to produce a relatively confined zone of direct oxygen to metal contact with respect to the total surface area of the bath.[53]

In examining the Suess specification, we see that the patentees assert "it is believed" after applying the oxygen jet in a particular way that it "brings about a flow in the molten metal . . ." and that "this apparent circulation" is facilitated by the shape of the bottom of the vessel.[54] Actually then, this was not an out-and-out declaration, but a belief and was well within the permissible limit allowed by law, since the law does not legally require an inventor to comprehend the scientific principles on which the practical effectiveness of his invention rests. The law is concerned only with the fact that the patent works. An in-

[52] Compendium VI, pages 117-118.

[53] Compendium V, page 101.

[54] Exhibit PX1, col. 4, lines 27-42.

ventor may be ignorant of the scientific principle or be uncertain about it, or even may be confident and others may think differently. But all of this is [32] immaterial, if by the specification the thing to be done is so set forth that it can be reproduced.[55] Nevertheless, the Suess patenteees did set forth the theory of the functioning of the chemistry upon the impingement of the oxygen by saying that due to the very high affinity of oxygen for iron, the initial contact of the high purity oxygen jet with the molten metal bath causes a rapid combination of oxygen and iron to form FeO in the confined central reaction zone. The action is detailedly set forth thereafter.

The first significant fact is that the reactions immediately develop an extremely high temperature in the zone of direct oxygen contact, and eventually approach the boiling point of iron. By this reaction it is indicated that a portion of the iron oxide *goes* to the slag and a portion *diffuses* into the bath and so forth.[56] The process is fully detailed in the specification thereafter until the flame dies and carbon combustion is completed when the bath becomes relatively quiet and then the oxygen stream impingement is insufficient to cause the continuance of oxygen-metal reactions.[57]

[33] My analysis indicated, and I so reported,[58] that nowhere in the specification is there any statement or inference that the oxygen jet physically induces motion or activity in the bath. But by the very words of the chemistry involved in the production of high temperatures, as well as the fact that the oxidation process is a combustion process and of an explosive nature, the oxidation-reaction provides the first movement in the bath and with it brings the iron

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[55] Compendium V, Physical-Mechanical v. Chemical, pages 104-105.

[56] PX1, col. 4, lines 43-60.

[57] PX1, col. 6, lines 66-72.

[58] Compendium V, pages 108-112.

oxide to the slag and a portion of it downwardly with chemical expansion which is produced by the process of oxidation. Logical and scientific explanations are discussed in Compendiums V and VI.

Thus, if I am correct, as I am fully convinced that I am, that the specification informs the steelmaker that the first motion or movement in the bath occurs because of chemical combustion and expansion, it would seem that the District Court misread the technical significance of what causes movement or action in the bath and mistakenly arrived at its thinking that the invention if it was to have any success must succeed on the physical aspect rather than the chemical aspect. This is borne out by the fact that the District Court eventually arrived at such a determination.

While the evidence was being presented regarding the differences in the physical processes between the June 17th, 1949 series of tests and those of June 25th, 1949, Dr. Trenkler [34] testified that only two changes were made (1) from a Laval nozzle to a cylindrical nozzle and (2) an increase in the nozzle bath distance from 10 centimeters to 15 centimeters. Without considering the balance of the 250 tests up to November, 1950, the District Court determined "The striking disparities in results of these three series of tests appears to this Court to be attributable solely to the *differences of impact pressure* . . ." (Emphasis added).[59] And it finally said,

> "However, the patentees must be credited with the invention under applicable law, because they took the final step of reducing impact pressure . . . Yet this final step of reducing impact was the difference between success and failure." (257 F.Supp. at page 419).

From various parts of the record, including references to the various claims filed, concerning the wording of "avoidance of deep penetration", the District Court concluded that the patentees seemed to have discovered "an

[59] 257 F.Supp. at pages 411-412.

intermediate degree of penetration between surface blowing and deep blowing",[60] and that this was "'. . . the real gist of the invention by the patentees . . .'" and "seems to have been unobvious, in view of the apparent failure of steelmakers to observe such limits of penetration while following the teachings of Schwarz and Miles patents."[61]

[35] Thus, we see that what might have been a simple adjustment by any steelmaker had become "the real gist of the invention". I take note of the fact that in addition to the District Court's disregard of the balance of the 250 tests up to November, 1950, that in examining the patent there is no mention either of a cylindrical (regular) or Laval nozzle, nor any teaching that the nozzle bath distance was to be 15 centimeters. This also raised further questions. If these two differences were the only two differences from the prior art, why was there any need for detailed instructions in the specification on how to make and use the patent process? Why did McLouth pay $100,000 for know-how, and why did J & L pay $285,000 for what it said was know-how, especially when they were, as they contend, practicing the Schwarz process? Then, too, if it was only a question of reducing impact pressure of the oxygen jet on the bath surface, why would Dr. Durrer have termed the Suess process a "new metallurgy with which we must first of all become acquainted?" And also, why should the impact pressure have needed only "a polishing up process", as Durrer suggested?[62]

[36] Assuming then that avoidance of deep penetration is the gist of the invention, the specification, itself, must of necessity in clearly related word support this statement. For if the specification does not support it, it would be totally irrelevant in the consideration of the validity of the patent.

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[60] 257 F.Supp. at page 403.

[61] Compendium IV.

[62] Compendium I, pages 38-40.

I observed that the word "gist" of the invention seems to be the result of evolutionary thinking in the District Court Opinion. It first came about as a contrast from Miles, where the "gist' of that invention was stated as a penetration of "almost all the fluid into the bath". While in the Suess patent avoidance of deep penetration was stated, in fact, to be the gist of the invention of the patentees. It was finally adopted after the conclusion on "reduction of impact pressure" of the nozzle on the bath.[63] It will be seen that for the most part the District Court attributed its finding to statements made by the plaintiffs' witnesses and the plaintiffs' counsel that the Suess patent avoids the deep penetration prescribed by the prior art and to the lessening of the impact pressure of the oxygen jet upon the molten metal bath. Its sole support in the specification, however, lay in four statements[64] which it extracted out of the context to which they related. Since these are discussed [37] detailedly under Compendium II, commencing with pages 77-78. I need only state here that each of these four quoted references presents the necessity for adherence to the instructions in the specification, with results as are distinguished from those in prior art, with the promise it seems that if instructions are followed that the "avoidance of deep penetration" as practiced in prior art with undesirable results will not occur or result in the practice of the instant patent.[65] Thus these four references do not indicate that avoidance of deep penetration is a factor, but do indicate that it is a differentiation from prior art.

Additionally, I have treated elsewhere[66] the statements that the prior claims originally filed and which were rejected or abandoned referred to "avoidance of deep pene-

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[63] Compendium IV, pages 97-98.

[64] Compendium II, page 76.

[65] Compendium II, page 91-92.

[66] Compendium IV, page 89-90.

tration" as the subject matter of the invention. When the language in these is pinpointed, it is observed that they do not so read but rather as a circumstance—a result which occurs if or when or while the Suess process is followed.[67]

[38] Both the specification and the claims *ab initio* gave the impression that deep penetration was an unwanted circumstances, which was evidently the thinking of the Primary Examiner in Division Three of the Patent Office who made the determination here and who sought to have the applicants change to more positive language. This was recorded in the file wrapper history. Claim 17 which became the new Claim 1 is made ". . . in view of the conference with the Principal Examiner on June 14, 1957 in order to improve the definiteness of the claim and to eliminate the negative limitation present therein."[68]

At the first post-trial hearing before me on April 29, 1970, Primary Examiner LeRoy so testified. He said "I thought that the language should try to bring out that the oxygen stream was confined or localized in the area somewhere near the surface of the bath. The deep language, the deep penetration, I thought, was well known in the art . . . but if you wanted to define this as being localized, I didn't like the language of 'avoid deep penetration'. So I suggested that they use something to show it was localized in that area . . . and so the language that we finally adopted there was to bring out that feature."[69]

At this point I considered the admissibility of the evidence [39] of the Primary Examiner and of the lawyer who had an interview with him, and concluded that even if the patent is considered a contract, the evidence was not offered for the purpose of changing, altering or modifying the contract, but rather disclosed that the purpose was "to

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[67] Compendium IV, pages 89-92.

[68] PX2A, page 98. Compendium II, page 58.

[69] Compendium II, page 59.

improve the definiteness of the claim and to eliminate the negative limitation present therein." Also in this connection, it was disclosed that no positive part of the subject matter was abandoned or relinquished by the applicants, nor that the Primary Examiner had intended in any way that they should do so.[70] Furthermore, the patent examiner was not concerned with any similarity in the instant patent application with the prior art, but rather with the words which expressed the theory and difference from the prior art.[71]

Further, the McLouth record, by reason of the *sua sponte* determination, indicates that the plaintiffs had no notice that this would be determined, especially in view of the fact that the defendant neither raised this point as an issue in the pleadings or at the trial of the case. This became the more crucial eventually reason of the added estoppel limitations set forth in *Blonder-Tongue*. I held therefore that the plaintiffs had presented [40] substantial evidence that without fault of their own, they were deprived of a fair opportunity to present evidence on the issue of file wrapper estoppel. Accordingly, the defendant was not entitled to the defense of the doctrine of file wrapper estoppel.

[41] **Localized Reaction Zone**

As relates to the District Court's determination that the localized reaction zone had been anticipated by and was obvious to both Schwarz and Miles, and furthermore that it was a fiction, the first distinction lies in the fact that Schwarz and Miles placed the localized reaction zone within the bath and were unable to prevent damage to the refractory walls. By injecting the oxidizing gas or liquid, Schwarz and Miles provided an elongated, circular oxidizing instru-

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[70] Compendium II, page 58-59.

[71] Compendium II, page 61.

mentality not only in the center of the bath but from the surface downwardly or angularly, depending upon how it was practiced, and a high temperature was created along its entire circumferential length.[72] By this process, on the other hand, it was neither localized nor controlled. The Suess process, on the other hand, by its instructions provided for a hot spot at the surface center of the bath, where the oxidation process was localized and controlled, and at a point away from the bottom and walls of the refractories thus eliminating a potential danger to them.[73]

So while the Schwarz and Miles process provided for an unrestricted and uncontrolled single acting high temperature device or devices, the Suess process provided in its specification for a dual process in which the oxygen impingement on the metal bath produced two different chemistry phases: first, the exothermic or heat producing phenomenon at the surface center of the bath where high temperatures were generated and activity or movement was initiated; and second, the endothermic (heat absorbing) phase **[42]** within the bath, by reason of the movement of the boiling iron from the hot spot or localized area downwardly into the bath where the high temperatures were diffused.[74]

[43] Double-phased chemistry was evidently not considered by the McLouth District Court, since the Opinion does not even mention it. Elsewhere I found that the localized reaction zone was actually the key which opened up the Suess process in accordance with the instructions set forth in the specification, and that this produced "a sufficiently high reaction velocity of the oxygen with the bath constituents to insure the development of autogenous heat . . . consistent with controlled temperature and con-

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[72] Compendium VII, pages 156-158.

[73] Compendium VII, pages 148-149.

[74] Compendium VII, pages 150-155.

trol and development of other necessary required process condition, such as fluid slag, avoidance of over-oxidation (undue loss of iron to the slag), and the avoidance of slopping."[75]

If the localized reaction zone, then, is read out of the specification, then the production of the "sufficiently high reaction velocity of the oxygen with the bath constituents" providing the necessary autogenous head and control and development of other necessary required process conditions, to which Dr. Durrer ascribed his idea of the new metallurgy, might also be read out of the specification, and then the words of the District Court would be realistic that "the localized reaction zone . . . could also exist even with deep penetration." For then we would be seeing the Suess patent eliminated and steelmen would be back to the prior art of Schwarz and Miles.[76]

[44] Then in accordance with the District Court's pronouncement that Schwarz and Miles also practiced the localized reaction zone, there was a failure to observe that Schwarz and Miles placed the localized reaction zone inside of the bath, where it was unlimited and unconfined.[77] Whereas in Suess, it was confined and localized at the central surface of the bath.[78] Under these circumstances, it would seem that the District Court would have misread the specification.

As for the District Court's assertion that the localized reaction zone was not supported in the specification, an abundance of detailed supports are set forth in Compendium VII, page ——.

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[75] Compendium VII.

[76] Compendium VII.

[77] Compendium VII, pages 149-150.

[78] Compendium VII, pages 152-153.

[45] **Substantial Distance**

The District Court criticized the words "spaced a substantial distance from the refractory lining" as this term modified the words "in a localized reaction zone," in Claim 1 of the Suess patent "as not giving any definite meaning for the patent in suit." In Compendium VIII, I explained that the word "substantial" is susceptible of different meanings according to the circumstances of its use; that specified instructions place it at the central surface of the molten bath and provides for the character and force of the jet impingement, and as well for the vertical and central jet placement within limits above the bath. In any event, the McLouth District Court answered that criticism when it held that "The specification gives the term (localized reaction zone) no specific meaning or definition at least in terms of numerical percentage of bath area of depth" and made clear what the size of the reaction zone must be so as to prevent "excessive refractory damage either to the bottom or walls of the vessel." Furthermore, it did "not prevent a steelmaker from making and using the invention on the basis of the disclosure of the specification."[79]

[46] **Onto and Below the Surface**

As for the criticism of the McLouth District Court, that the words "onto and below the surface of the bath" were overbroad, I pointed out that the District Court itself had said that the patent ". . . in several places uses the term 'some penetration' but not 'deep penetration'."[80] It also knew that the simple blowing upon the surface forms an indent from shallow to deep.[81] Further, it suggested that the word "below" would seem to cover even a deep pene-

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[79] Compendium VIII, pages 167-174.

[80] Compendium IX, page 181.

[81] Compendium IX, page 182.

tration of the bath by the oxygen stream "which is certainly not taught by the specification."[82] The District Court refused to accept the argument of plaintiffs' counsel that "avoidance of deep penetration" means a "practically negligible penetration of the surface of the molten metal by the oxygen jet."[83]

The answer to the District Court's criticism is (1) that the word "below" does not necessarily mean deep[84]; (2) that the two words are used conjointedly and when two words such as "onto and below" appear in combination they must be read together within the framework of the specification itself[85]; (3) that under the rule of *noscitur a sociis,* the meaning of the doubtful word may be ascertained by reference to the meaning of words associated with it, thus these words take color from each other and other **[47]** associated words and convey technical significance to the subject matter of he claims[86]; (4) that a reasonable construction of the claims and specification clarifies the term, particularly when there are abundant references which give it meaning[87]; (5) the blowing of the jet upon the liquid bath in creating some denting or hollowing of the surface no matter how trivial providing a concavity literally dips lineally below the surface[88]; (6) the chemical inter-penetration and combination of the oxygen and iron literally give meaning to the words "onto and below" because it breaks the surface linearity[89]; and (7)

[82] Compendium IX, page 175.

[83] Compendium IX, page 175.

[84] Compendium IX, page 175-179.

[85] Compendium IX, page 175-178.

[86] Compendium IX, pages 177-178.

[87] Compendium IX, pages 181-182.

[88] Compendium IX, pages 178-184.

[89] Compendium IX, pages 184-187.

that a person skilled in the art will understand the term by reason of the variety of explanations on the instructed impingement of the oxygen jet on the surface of the bath, and so will understand how to project or discharge the oxygen upon and below the bath surface and thus produce the steel promised in the patent without unduly damaging the refractory lining of the vessel.

[48] **Material Agitation**

The McLouth District Court criticized considerably the term "avoidance of material agitation." [90] The word "agitation" appears only twice in the patent: once in Claim 1 and once in the specification. In the specification it is used in a two-fold sense: first, a resulting activation caused by the rapid formation of carbon monoxide, and second, the causative increased activation of the circulation already existing in the bath. The specification states that the "reaction of carbon with the FeO and directly with the oxygen gas in the confined direct oxidation zone causes rapid formation of carbon monoxide . . . [which] . . . causes a strong boil or agitation of the bath," and that this augments the bath circulation to continuously present unrefined metal to the oxygen gas reaction zone, and so forth. Thus the word "agitation" finds itself identified as a chemical result and in turn as a physical impetus to the already existing circulation in the bath. On the other hand, the word "agitation" in the Claim is involved only in its physical sense. It is not an instruction or explanation of how to make the Suess process functionable, but rather of how *not* to interfere with its functioning as it was taught in the prior art. [91]

[49] The prior art taught that the physical application of the oxygen jet "in the manner of a solid body" or by

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[90] Compendium X, pages 188-190.

[91] Compendium X, pages 191-192.

liquid oxidizers would provide the agitation or stirring action within the interior of the bath in order to bring about chemical results.[92]

The word "turbulence" was used in the specification but it was used in the sense of bath activity, chemical reaction or chemical combustion, and used to state that when the carbon oxidation was complete, the ignition and visible flame commenced within the first minute of blowing came to an end and the bath became relatively quiet because the "turbulence of the bath and slag due to the oxygen stream impinging" could no longer have any chemical reaction or turbulence effect—because combustion had been completed.[93]

Further, the District Court evidently keeping in mind that the specification asserted that the oxygen jet produced the circulation in the bath, and that the adjustment of the oxygen jet actually was the gist of the invention, was unable by this thinking to separate the significance of chemically induced circulation or [50] reaction or turbulence, and gave them all an identity of meaning, as is evident by the fact that it used them interchangeably as actions in the bath caused by deep penetration and as circulation or action in the bath caused by chemical reaction.[94]

Although the District Court eventually ruled that the term "avoidance of material agitation" could not have been a meaningful concept to persons skilled in the art at the time the invention was made, it was contradicted by the District Court itself when it found that ". . . the specification of the patent in suit . . . nevertheless complies with Section 112 by disclosing the invention in sufficiently clear terms to enable steelmakers 'to make and

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[92] Compendium X, pages 192-193.

[93] Compendium X, pages 198-199.

[94] Compendium X, page 199.

use the same'." [95] Also, while the District Court made the finding that "avoidance of material agitation" has no causal connection with the term "avoidance of deep penetration," it nevertheless stated that "The Rinesch and Hauttmann affidavits in 1957 attributed . . ." such a causal connection. But still in all, it was not shaken from its belief that avoidance of deep penetration is the gist of the invention," and it found no "clear connection" of this to "avoidance of material agitation, because the **[51]** applicants could have provided more suitable words to the patent efforts.[96]

I am convinced that because of the overall meaning which the District Court gave the word "agitation" as including bath action, reaction, circulation and turbulence, it possessed no technological comprehension of the significance of each as the Suess patent set them forth and explained them. Thus a conflict was formalized between the significance of the term "avoidance of material agitation" and the term "avoidance of deep penetration."

While it is apparent to me that to some extent the plaintiffs' experts (as well as the defendant's experts) failed to adequately explain both the factual and scientific factors involved, as is frequently seen from the manner in which the word "agitation" was loosely used in the questions and answers as presented before the District Court,[97] I observed with what exclusivity the patentees chose their own words or phrases, as for instance "impinge," "surface," "reaction," "high temperature" and "circulation." I observed, too, that the word "turbulence" was used only once and that the word "agitation" was used only twice. Thus it was significant that the patentees chose words **[52]** which would best explain the

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[95] Compendium X, page 207.

[96] Compendium X, pages 200-201.

[97] Compendium X, pages 219-220, 222-228.

circumstances and their environment. When it used the word "agitation" in the Claim it did so in the sense of actuating, provoking, stirring or prodding into action and in its negative and cautionary sense. In the environment in which the word "agitation" was used in the Claim, there is seen at once the limiting or preventive activation or stirring of the bath by the oxygen stream, and it becomes quite obvious if we hypothetically and experimentally substitute the word "stirring" for the word "agitation" in the claim, the significance is unmistakable.[98] And although the District Court criticized the use of the word "agitation" as being "an obvious attempt to distinguish the Miles patent," no blame should be attached to the patentees for so doing, because the law requires that the claim distinguish the instant patent from the prior art.[99]

As for the District Court's use of the word "agitation" interchangeably with action, circulation or turbulence in the bath, the District Court found corroboration for its thinking that "agitation" was the sum total of activity in the molten metal bath while it was in the process of oxidation reaction in particularly **[53]** one of ten demonstrations which were carried on before the Court by the defendant at Ann Arbor, Michigan. Here the District Court interchanged the significance of the word "agitation" with throw-out from the converter. I treat this matter separately later.[100] By the expression of the District Court regarding this "throw-out," it was obvious that because the difference of the activity within the bath during the functioning of the chemical process could not be visibly distinguished or sensed from the "stirring" function by the operator, there was confusion as to the significance of both and a failure of conception of their difference.[101]

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[98] Compendium XII, page 226.

[99] Compendium II, page 71.

[100] Compendium VIII, page 233-284.

[101] Compendium VI, pages 122-123.

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[95] Compendium X, page 207.

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[97] Compendium X, pages 219-220, 222-228.

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[98] Compendium XII, page 226.

[99] Compendium II, page 71.

[100] Compendium VIII, page 233-284.

[101] Compendium VI, pages 122-123.

The District Court also criticized the use of the word, "avoid material agitation" because, as it had already found previously, the specification presented a physical creation of circulation by the oxygen, and that by the use of this term the applicants were attempting to change to a chemical theory of physical circulation. As already explained, this may merely be said to be an assmption without basis in fact. From all of this we are reminded that the applicants throughout their specification and claims made it clear that they did not have a theory of "agitation", but one of "circulation" caused by the chemical [54] reaction originating in the localized reaction zone at the place of impingement of the oxygen to metal. As for the reference "to such an extent as to avoid material agitation" this does not appear to be an instruction of how to make the Suess process functionable, but rather of how not to do it, as it had been done in the prior art.[102] Thus it is obvious that the word "agitation" as contained in the phraseology or terminology of the claim is not fictional but has substantial significance to persons skilled in the art of steelmaking to abide by the instructions contained in the specification and not to apply the oxygen jet physically as was the custom in the prior art.[103]

With the explanation of the two-phase character of chemistry action in the bath, of exothermic in the top surface center, the plaintiffs' experts in reality were saying that any application of the jet which would physically interfere with the localized reaction zone would be considered as blowing the oxygen jet to such an extent as would materially agitate the bath; for then the exothermic chemistry would be interferred with, overcome or upset, and the localized reaction zone would no longer function, or be handicapped in functioning as the Suess process contemplates.

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[102] Compendium XII, page 232.

[103] Compendium XII, pages 230-232.

[55] **3000-8000 to 1**

The District Court found that "on the basis of the plaintiff's own testimony the concept of material agitation of the bath by the oxygen stream is purely fictional." "The basis" seems to be the District Court's interpretation of what Dr. Ascher H. Shapiro, Professor of Mechanical Engineering at Massachusetts Institute of Technology, plaintiff's witness, testified to that the force of chemical reactions in the bath would be "roughly 3000 times stronger than the force of the jet blowing vertically from above . . ." [104] And later, Dr. Shapiro said that the power of the chemical force was 8000 times stronger than that of the jet. Thereupon the McLouth District Court wanted to know how the one unit of "material agitation of the bath by the oxygen stream" could possibly interfere with a force that was 3000-8000 times stronger than it.

Dr. Shapiro, a specialist in the field of dynamics presented evidence for the purpose of showing what caused the circulation in the bath, mechanical or chemical. In explaining what caused the circulation in the bath, he arrived at two units, one of force and one of power. He made no mention at this time of any potential application of the jet to the agitation of the bath. His evidence opposed that of the McLouth expert who attempted to show that the circulation was produced by the jet and thus physically it was upward in the center. He calculated that the total frictional force applied by [56] the jet was 6½ pounds; that its downward force was in the neighborhood of 350 pounds, which could only produce an indent and could not produce motion in the bath, and so it had no

[104] Elsewhere he does discuss the primary carbon monoxide bubble created in the hot temperature zone (the exothermic action) as shooting explosively downward, and the later (endothermic action) neucleation of secondary bubbles at the bottom and walls of the vessel which gives buoyancy to the liquid in the bath and moves the liquid upwardly, and so aids circulation within the bath.

potential for producing circulation in the bath as was claimed by the defendant, McLouth.[105]

With some little chemical understanding of what the specification recites on the chemistry of the process (col. 4, lines 43 et seq.), we comprehend that there are no antagonistic forces working against each other by the physical action of the oxygen jet and the chemical action which it in turn generates.

In a ladle-rudder exhibition at Linz, Austria, as reproduced in a movie,[106] I saw the oxygen turned on and off. When the oxygen was turned on, the combination-conversion started and out-throw resulted; when it was turned off, the oxidation-combination stopped and the out-throw abated. What we see in this process is a "before and after" marriage symbol by which oxygen on the one hand and iron, silicon, phosphorus and so forth on the other hand become atomically united and combined. Take for instance the ordinary household match. Innocuous as it lays [57] undisturbed, but when its head is rubbed to such an extent as to become heated in the presence of oxygen (air), it bursts into flame. The oxygen which is consumed by this combination from the air is an infinitesimal quantity compared to the flame to whose generation it gave itself. So in the molten metal bath when the oxygen impinges upon the molten metal, most of the oxygen in the jet becomes chemically converted and disappears in its elemental state as oxygen. Thus the answer to the District Court's posed query is that the Suess process' one unit of physical force-power of the oxygen jet does not overcome the 3000-8000 units of chemical force-power, but rather generates it and combines with it as the process proceeds.

While this might have given the District Court some clarification of its misconception of what caused physical

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[105] Compendium XI, pages 215.

[106] Compendium XI, page 216-217.

material agitation in the bath as against chemical action, Dr. Shapiro's testimony seems to have miscarried because first, his testimony never contained any statement regarding "material agitation" of the bath, and second, because his testimony related strictly to the dynamics by which circulation in the bath could occur, either mechanically or chemically.[107] However, it is evident that Dr. Shapiro's testimony alone wasn ot the real "basis" for the [58] District Court's conclusion regarding "material agitation of the bath by the oxygen jet" as such terminology was interrelated with the words of the claims by what the District Court concluded from Dr. Elliott's testimony.

[59] **Ann Arbor Tests**

The District Court stated that ". . . tangible evidence in the record tending to confirm that the concept of material agitation by the oxygen is a fiction" and thereafter proceeded to discuss three of a series of five tests which had been conducted by the defendant's expert at Ann Arbor, Michigan before the District Court.

The defendant in support of its contention that it was practicing the deep penetration of the prior Schwarz art, submitted the Ann Arbor demonstrations for the purpose of showing the effect upon steelmaking and steelmaking equipment of varying depth of penetration and a method of measuring penetration.[108]

The "tangible evidence" in the record consists primarily of what the District Court extracted as being "tangible evidence" principally from Demonstration No. 7. Here the same fifteen inch vessel containing about 270 pounds of iron was used for the demonstration. After two minutes of supplying the oxygen at the rate of 20 psig, the pressure was increased to 40 psig until the carbon end

[107] Compendium XI, page 215.

[108] Compendium XIII, page 233.

point occurred. The District Court described the [60] physical results when it said ". . . large amounts of slag and metal were thrown up and out of the converter onto the floor, indicating a violent agitation of the metal bath". Then it concluded "In other words, the 'agitation' of the bath as shown by 'throwout subsided . . ." Thereupon it found this as a fact:

> "If the bath agitation caused by such throw-out metal and slag had been caused by the mechanical action of the oxygen stream alone, the throw-out would not have ceased as it did near the end of the blow. It is obvious, therefore, that the action of the oxygen stream alone was not responsible for the agitation of the bath causing throw-out of metal and slag during the major part of the blow." [109]

By these statements we see, first, that the word "agitation" encompasses the word "turbulence" as it was used in the specification (col. 6, line 69), as the total action of the bath during the course of the process, and that this was synonomous with "throw-out". We see also that in this connection it describes the total chemistry action in the bath during the processing, and as such, it has no relationship to the physical character of the word "agitation" as described in the claim. Thus a comingling of the functions of these seems to show a lack of the comprehension of the difference between them. [61] First, the specification never indicated that the oxygen stream was in any way physically responsible for the activity in the bath, but rather maintained throughout that action, movement or circulation was produced as a result of the chemical reactions in the bath. And second, the very thing which happened in Demonstration No. 7 upon the completion of the carbon combustion is what the specification describes will happen in the practice of oxygen application on the surface of the bath "When the flame dies and carbon com-

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[109] Compendium XIII, page 259.

bustion is completed, the bath becomes relatively quiet and intimate contact between slag and metal bath ceases. The turbulence of the bath and slag due to the oxygen stream impinging from directly above is insufficient to cause continuance of oxygen-metal reactions." (col. 6, lines 66-69). In other words, it was as if this reference did not exist, and the District Court discovered it for itself in observing Demonstration No. 7. Thus its reliance on Demonstration No. 7 as "tangible evidence in the record tending to confirm that the concept of material agitation by the oxygen is a fiction" is misconceived and misplaced. This is so also by reason of the fact that the defendant did not offer these demonstrations in [62] evidence for the purpose of contradicting the fiction or non-fiction of avoidance of material agitation, and yet the District Court adduced this as a factual finding. There are other reasons why I believe that Demonstation No. 7 does not present "tangible evidence in the record" and it is necessary that these be enumerated.

Another pertinent test at Ann Arbor was Demonstration No. 9, purporting to show that it was the oxygen jet which burned the hole through a prepared refractory bottom brick.[110] The bottom refractory brick had been bored leaving a thickness of 15/16th of an inch from the bottom. The demonstration started with a pressure of 20 psig and that was raised after two minutes to 40 psig. According to defendant's expert, Dr. Flinn, the oxygen jet burned the hole through the refractory and in the molten metal[111]. He said that forty seconds later he saw "the *gas jet* coming through the bottom *in the form of a flame*".[112] He said that the "flaming gas jet" coming through the bottom proved that "the jet penetrates through the bottom".[113] He said it came

[110] Compendium XIII, page 235.

[111] Compendium XIII, page 235.

[112] Compendium XIII, page 236.

[113] Compendium XIII, page 237.

through for about ten seconds until the pressure was cut back to ten psig. After the pressure was lowered, he saw a metal stream **[63]** coming out, and when the pressure was raised again to 40 psig, they again saw the flame coming through the bottom. The pressure was then shut off and the rest of the metal or most of it ran through the hole.[114]

Oxygen is Invisible and Does Not Burn

Dr. Elliott for the plaintiffs testified that the oxygen did not cause the hole in the bottom and that it was the downwardly moving stream saturated with carbon and oxygen which burned the hole through. Although Dr. Chipman, another plaintiffs' expert, said that it was silicon and oxygen which combined in the metal to form silica and became destructive to the bottom refractory as it struck.[115] Whether it was the carbon monoxide burn-through or the silicon burn-through, it was not questioned or discussed by the District Court, and is in effect an immaterial issue here.

What is meaningful here is that the defendant's Vice-President of Engineering, Lyle Johnson, testified that in the test where they blew oxygen into an empty vessel on bare brick which was heated to a temperature of 2000 degrees, the test **[64]** "proved that oxygen by itself will not burn a hole in the brickwork". McLouth's General Superintendent of the Hot Metal Division, Mr. Paul Lindberg, also contradicted Dr. Flinn's assertion by his testimony when he said that the marking on the bottom of the vessel "is caused by the metal of extremely high temperature hitting the bottom".[116] But what is more incredible is that Dr. Flinn says that he saw a jet of oxygen extruding from the bottom of the refractory "in the form of a flame". If it was a flame, then it was the combustion of oxygen with

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[114] Compendium XIII, page 237.

[115] Compendium XIII, page 238.

[116] Compendium XIII, at page 239.

some one or more of the oxidizable impurities contained in the bath, whether of silicon, manganese, carbon or other impurities. The point is that we cannot see oxygen as is obvious when we look at its one-fifth content in the air. It will not burn even though it, itself, supports the combustion of substance. So that when Dr. Flinn said it was "visible" that it was a "flame" coming through the bottom, he saw the combustion process of burning gases or a flame, which in this case was described as having a "bright orange-red" color. Such a flame was colored by energized ions emitting light energy, as well as by bits of solid material heated to incandescense by the reaction energy.[117] Thus the burn-through was not caused by the oxygen jet, but by flame, fire or combustion, and thus Dr. Flinn's testimony in connection with these tests becomes objectively discredited as "tangible evidence in the record".

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Demonstration Steel Quality and Nozzle and Refractory Damage

Another distinct difference between the Michigan demonstrations upon which the District Court relied as "tangible evidence in the record" is that while Dr. Flinn testified that in Demonstration No. 5 the steel produced had the characteristic of ductility, and in Demonstration No. 7 "We have bottom burning but we still have steel", and of no description of the quality of steel blown in the 185 seconds of Demonstration No. 9, the significance is that there is nothing in the evidence by McLouth that particularly Demonstrations Nos. 5 and 7 produced steel equal in quality to that obtained by McLouth in its OP-1 and OP-2 shops.[118] And even more important, there is not a single word in the McLouth Record that the resultant products from these Ann Arbor demonstration produced "steels having analyses

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[117] Compendium XIII, at page 240.

[118] Compendium XIII, page 248.

and qualities at least comparable to that of the basic open-hearth steels" as is the object of the Suess process.[119] Finished steel has a variety of virtues depending upon the applicability of its use. However, strength is steel's primary virtue.[120]

In the case of Demonstrations Nos. 5 and 7, while we are informed that the silicon and "most of the manganese have been eliminated", we are told nothing about sulphur and phosphorus removal.[121] In addition to the lack of the description of the [66] products produced in these demonstrations Nos. 5 and 7, no information is given on nozzle and refractory damage as these might or might not show comparability to the OP-1 and OP-2 operations at McLouth, and of the Suess process operation. In any event there is no doubt that the Ann Arbor demonstrations were not models of the Suess process, or examples of the process as it was described and intructed in the Suess specification. The most important circumstance is that of incomparability of the alleged model demonstrations with the realities of the Suess conditions.

[67] *Dr. Elliott's Credibility*

The "tangible evidence" is supported, not by the defendant's expert witnesses, but by the discrediting of the plaintiff's expert witness, Dr. Elliott. Although several statements are made in the District Court Opinion regarding the inconsistencies or contradictions of Dr. Elliott's testimony, such as that Dr. Elliott relied on the quieting of the bath at the end of the blow as a sign of avoidance of material agitation of the bath by the oxygen stream, which I discuss in another related matter,[122] two important criticisms leveled

[119] Compendium XIII, page 249.

[120] Compendium XIII, page 250.

[121] Compendium XIII, page 248.

[122] Compendium XIII, at page 257.

against Dr. Elliott by the District Court relate to Demonstration No. 9 as assumedly being "tangible evidence".[123]

The first discredit attributed to Dr. Elliott was that he "... defined deep penetration by reference to such bottom damage ... when the jet enters more than say 35 to 40 percent of the bath depth ... [and] would have regarded the penetration in demonstration No. 9 as being at least 35 to 40 percent of the bath depth. Yet he later testified that the penetration of the jet in Demonstration No. 9 was no more than 1.5 inches of a 6.8 inch bath depth, or approximately 22 per cent of the bath depth." The difficulty with this statement by the District Court is that it was apparently not aware of the fact that it was comparing two different sets of circumstances, like the proverbial apples and oranges.

[68] *35-40 percent or 22 percent*

On the basis of the "tangible evidence", Dr. Elliott a plaintiffs' expert witness, is discredited not only as his testimony related to Demonstration No. 7, but also as it related to Demonstration No. 9. The District Court stated "Dr. Elliott himself relied on the quieting of the bath at the end of the blow as in Demonstration No. 7 as the sign of avoidance of material agitation of the bath by the oxygen stream." What Dr. Elliott was testifying to was that McLouth in the operation of its oxygen plants was operating so as to avoid material agitation of the bath by the oxygen stream. He said that they were pointing the jet vertically and centrally on the surface of the bath; that there is no deep blowing or penetration of the oxygen into the bath; that at the end of the bath there is a quieting because the chemistry which caused the agitation [not material agita-

[123] This conclusion is taken out of context from the testimony as a whole by Dr. Elliott who was presenting a series of reasons why in his opinion McLouth was practicing the Suess patent and was avoiding the material agitation of the bath by the oxygen stream, as was done in the prior art. (Compendium XIII, page 242-47).

tion] or chemical action in the bath diminishes; and that the jet which is blown heavily presents only a small force or trivial force as compared to the chemical action or agitation.[124] Dr. Elliott cites other points but these are not material here. What is noticeable is that Dr. Elliott used the word "agitation" in connection as it reflected chemical action in the bath, and this may have misdirected the District Court into making the statement that Dr. Elliott relied upon quieting of the bath at the end of the blow as a sign of avoidance of material agitation of the bath by the oxygen stream. Taken in its full context, it may or may not [69] have been a misconception attributable to Dr. Elliott's testimony.

The first completely different set of circumstances to which Dr. Elliott testified related to his opinion of the Suess specification of allowing not more than 35-40 percent of the bath depth. The second and completely different set of circumstances related to that existing in Demonstration No. 9 where he testified that "The indent under these blowing conditions would range from between 6/10 of an inch to approximately 1½ inches, 6/10ths of an inch to approximately 1.5 inches."[125] From this second set of circumstances, the District Court estimated his statement to be about 22 percent depth of penetration. By relating the two different sets of circumstances and interpreting them to be directed only to the circumstances of Demonstration No. 9, a highly technical oversight occurred.

From a review of the conditions provided in the Suess specification instructions[126] and their comparison with the Ann Arbor demonstrations' circumstances,[127] we see an enormous difference. Because of the wide variation of the

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[124] Compendium XIII, at page 257.

[125] Compendium XIII, at pages 242-243.

[126] Compendium XIII, at pages 245-246.

[127] Compendium XIII, at page 246.

nozzle diameter in the Ann Arbor tests, alone, we see the facility for introducing 58 times as much oxygen into the bath in Demonstrations Nos. 5, 7 and 9 as was prescribed by the Suess specification.[128] [70] Accordingly, I believe that there was a failure of identity recognition between the two, that is of the prior testimony of Dr. Elliott in testifying to the allowable limits of penetration under the Suess process and his testimony under the Ann Arbor demonstrations, such as would have mislead the District Court into a pronouncement and finding which was crucial under the circumstances.

In any event, the circumstances of the Demonstrations Nos. 5, 7 and 9 as made would disqualify them as competent evidence in the case on the technicality involved. Accordingly, by reason of such misunderstanding, the expert, Dr. Elliott, should not have been charged with a discredit in this connection and in justice it should not have been used even as a fractional support for a judicial observation that the Ann Arbor Demonstration No. 7 was to any degree "tangible evidence in the record tending to confirm the concept of material agitation by the oxygen stream is a fiction." [129]

[71] **Up and Down at the Same Time**

The second discredit ascribed to Dr. Elliott related to his testimony that "deep penetration causes an up in the center circulation which may cause refractory wear on the walls near the bath surface" as against his testimony, when he said that deep penetration causes bottom damage to the refractory as the result of a downward moving stream of hot metal in the center of the bath. The District Court concluded from this that "Clearly circulation cannot be both up and down in the center at the same time.[130]

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[128] Compendium XIII, at page 246.

[129] Compendium XIII, at page 247.

[130] Compendium XIV, page 271.

This was another case of matching two different sets of circumstances. In the first Dr. Elliott was explaining the chemically induced circulation which resulted by following the instructions contained in the Suess patent specification and the advantages of such a circulation as promised by the Suess patent from chemical reactions.[131] This was contrasted against mechanical circulation which was produced by deep penetration of the oxygen jet into the bath, as in the case of the prior art and the effects which it produced not only by reason of interference with the chemical process as prescribed by Suess, but also as relating to damage to the refractories. In chemical functioning, he explained that the Suess patent eliminated the stirring action produced by the jet in deep penetration; that as a substitution for such stirring action, Suess provided for having a chemically [72] produced circulation initiated at the central surface of the bath. He explained how the prior art of deep penetration produced unwanted mechanical action in the bath and produced resultant effects, but that in the case of the Suess instructed chemically-circulated action downward into the bath, the bottom and sidewall refractories were protected. He explained that the deep penetration mechanically forced the circulation up in the center backwards, outward on top to the side; that the hot metal was quickly carried to the walls of the refractory and so damaged them. Whereas under the Suess instructions, the hot metal circulated downwardly to the bottom, outwardly to the sides, upward at the sides and then back to the center surface; and that this permitted the hot metal to throw off heat, while so circulating.[132]

From my inquiry into this subject matter and more on the basis of common knowledge rather than of any knowledge of physics, my study shows paradoxically that ". . . circulation [can] be both up and down in the center at the

[131] Compendium XIV, page 272.

[132] Compendium XIV, page 271-273.

same time", in a molten metal bath which is activated by an oxygen blow. This is true especially where the oxygen is charged by a centrally and vertically placed oxygen jet directed to the surface of the molten metal bath.

[73] There can be no argument that the oxidation-reaction process produces an upward out-throw as was described by the District Court in its observation of the demonstrations carried on before it at Ann Arbor, Michigan. In spite of the fact that the District Court mentioned the "explosive bubble mechanism" [133] which showed the movements both upwardly and outwardly from the bath and at the same time downwardly into the bath to the bottom and outwardly to the walls, upwardly towards the surface and inwardly thereafter, there was presented into evidence a series of explosions produced by squibs and oxyacetylene, all of which presented the same character of throw-out and movements in the bath, both up and down at the same time. These, however, were not mentioned and presumably not considered by the McLouth District Court.

And yet comparing these demonstrations as they were produced at the McLouth trial (and as they were produced before me in these J & L actions), it is remarkable how these demonstrations reflect words of the specifications which explain in col. 4, beginning with line 43 the reaction in various steps of the Suess chemical process.

[74] However setting this aside, and even for the moment disregarding the testimony of the experts that the ignition and combustion in the bath produced by the oxygen contact with the metal, produced explosive activity and motion in and out of the bath, I relate this to the principle of action and reaction based upon the theory of Newton's Third Law of Motion which reads: "Action and reaction are equal and opposite." [134] When a bullet is fired from a

[133] Compendium XIV, page 276.

[134] Compendium XIV, page 281.

gun, it also produces a backward force on the gun.[135] The law of motion and recoil holds true particularly in an airplane with jet engines or rockets. It is the exhaust and forward motivation by which the hot gases are ejected and which gives the engine or the rocket its forward thrust.[136]

In the case of Demonstration No. 9 a particular shallow bath of 6.8 inches with the capability of introducing 58 times as much oxygen into the bath to a 22 percent depth might indeed be close enough to bring the high temperatures which the oxidation-reaction created in direct contact with the refractory and damage it. I noticed, however, that the District Court Opinion does not set forth any contradictory evidence by any of the experts, and particularly that where deep penetration occurs, the sidewalls at the [75] interface are not damaged.[137] On the contrary I observed that the evidence of one of McLouth's experts, Dr. Robert Pehlke, an associate professor of Metallurgical Engineering at the University of Michigan, testified that he saw upward circulation in the bath in a demonstration which he carried out. Thus, when the plaintiffs say that when the jet is placed low in the bath, as practiced by the prior art of Schwarz and Miles, the result produces a mechanical motion or movement upward in the center. There seems to be no disagreement on the part of the defendant on this point.[138] On the other hand, there was never any disagreement by the defendant with the plaintiffs that when the oxygen made a surface impingement sufficient to combine with the impurities of the bath, no damage resulted either to the bottom or the sidewall refractories.

In any event, all of this is of a scientific nature and whether the Suess patentees knew how and why their

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[135] Compendium XIV, page 281.

[136] Compendium XIV, page 281.

[137] Compendium XIV, pages 273-282.

[138] Compendium XIV, page 274.

patent worked, as indeed it did, it was not required of them that they know; all that was required of them was that they produce a working patent. Therefore, what I have here discussed was not whether [76] the patentees really understood the how and why of their patent's scientific workings, but only for the purpose of ascertaining whether or not there was any misconception of the scientific values or any misinterpretations of the specification or of the expert testimony, which may have unjustly formed the basis of the final determinations of the prior McLouth Courts.[138]

[77] As relates to the District Court's criticism of Dr. Elliott, the opinion mentions nothing about a weighing of the credibility factor of Dr. Flinn's expertise as against that of Dr. Elliott. The findings were based only upon the District Court's own perceptions and conclusions as drawn from its observations of Demonstrations Nos. 5, 7 and 9 with discredit to Dr. Elliott's expert testimony.[139] If, therefore, the District Court's perceptions were misconceived or even lacking in conception or perception, without fault on the part of the plaintiffs, and if such mislead the Court of Appeals, then such findings in the District Court opinion would in these cases before me present circumstances which I would be compelled to consider on the question of whether or not it would be unjust and inequitable to stop the plaintiffs from proceeding in these actions.

Since the District Court would not give credit to the explosive bubble demonstration advanced by the plaintiff, because it "was admittedly not contained in any literature prior to the time of trial", counsel were encouraged to present published [78] literature on any relevant statistical or scientific matters, and graciously responded with an abundance of literature broadly relating to the subject matter.[140]

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[138] Compendium XIV, page 283.

[139] Compendium XIV, at page 282.

[140] Compendium XVII, at page 357 Compendium.

Because of this help and of my own sparse knowledge, the chemistry and physics involved in the process, not only of Suess but of Schwarz and Miles as described in their specifications, I was enabled to carefully check scientific accuracy, as best I could, of the experts on both sides. As for instance, in the spot check of Dr. Shapiro's testimony, although a number of his assertions caught my attention as they were almost casually made, I chose one of his statements relating to calculations in physics. He said that the pressure at the top of the bath being 1 atmosphere, the atmospheric pressure of a sixty inch depth of bath was 2 atmospheres. Supporting my own calculations by a well-known Standard Handbook for Mechanical Engineers, I checked [141] and recalculated 1 atmospheric pressure at the surface as against the 2 atmospheres at the sixty inch depth of bath and found that the atmospheric pressure would be calculated as 14.6 divided by [79] 14.6 which would equal 1 atmosphere (rounded out) of the sixty inches, and when added to the 1 atmosphere at the surface it showed the 2 atmospheres as testified to by Dr. Shapiro.

Primarily my inquiry and research in the preparation of this report and opinion was a matter of hindsight, because I was enabled to acquire considerable technological education and insight into the scientific features involved not only in the Suess et al. patent, but also the prior art patents. The prior District Court found as best it could from the mass of evidence and exhibits, most of which could not be detailedly and fully examined, no special significance to the technology involved in the subject matter, while I on the other hand was not so hampered.

In any event, from this phase of what the District Court considered "tangible evidence in the record" as derived from Demonstrations Nos. 5, 7 and 9, it did not become apparent to the District Court that these demonstrations were grotesquely incomparable to that prescribed by the Suess process, or even to the McLouth operations OP-1

and OP-2; that these demonstrations allowed for approximately 58 times as much oxygen to enter into the baths as was prescribed by the Suess process; that oxygen [80] is not visible; that oxygen does not burn; that Dr. Elliott did not contradict himself by saying that bath depth in Demonstration No. 9 was 35-40 percent at one time and 22 percent at another time; that there was no proof that these tests produced the quality of steel which the Suess et al. process produced; that, in fact, no proof was presented on the actual quality and utility of such steel produced as claimed; that the series of conclusions was based on certain hypotheses in order to arrive at the District Court's findings on "avoidance of material agitation by the oxygen stream", with or without deep penetration, was a fiction; that visible throw-out from the demonstrations as seen by the District Court was chemical in causation and was not referred to in the specification as "agitation"; that the specification never suggested that such throw-out was the result of the physical jet action on the bath; that the evidence of the defendant's expert witnesses was not availed by the District Court for its support of the defendants contention, but that instead the negative conclusions drawn from the plaintiff's witnesses, particularly Dr. Elliott, was availed as the foundation for the finding of "tangible evidence in the record"; and that from all of this I am persuaded that the District Court lacked certain technological perceptions, and as a result misinterpretations were made contrary to scientific truths.

[81]

Prior Art Changes in Linz Tests

The District Court Opinion discussed two series of tests conducted by the applicants at Linz Austria in 1949, specifically those commencing on June 17th and those commencing on June 25th. It concluded that because the June 25th series of tests produced a better quality of steel as against the poor quality of steel produced in the June 17th tests, it occurred because of (1) the change from a Laval nozzle in

the June 17th series to a normal cylindrical nozzle in the June 25th series, and (2) a change in bath distance from 10 centimeters in the June 17th tests to 15 centimeters in the June 25th series.[141] It held furthermore that the "plaintiffs also admitted on final arguments that the only mechanical changes in method from the teachings and disclosures of Dr. Durrer and Dr. Hellbruegge were the change from a Laval to a normal nozzle and an increase in the nozzle bath distance." [142]

The applicants had decided to take the advice of Dr. Durrer and continue experimenting on the Schwarz patent. On June 3rd, they made their first test, but the nozzle melted from being too close to the molten bath surface. After they had started the second test on the same day, the surround containing the water for cooling the nozzle broke somewhat high above the nozzle and water sprayed on the surface of the bath and [82] they obtained a better quality of steel. This set them to thinking and they considered "a new concept, a new mental approach" that perhaps the deep penetration of the Schwarz process was not a desirable practice. On the third test made on June 9th, the experimenters conceived the idea that greater nozzle to bath distance and lower pressure and flow rates were called for.[143] In the meantime they carried out a number of tests, but they came to the determination of testing two ways, one in accordance with the teaching of Schwarz and the experimentations of Durrer and Helbruegge at Gerlafingen, and a second in accordance with their "new mental approach". On June 17th they started with the Schwarz prior art concept of deep penetration, and commencing on June 25th through the 27th they conducted eleven tests with the changed conditions. These tests demonstrated that satis-

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[141] Compendium XV, pages 286-287.

[142] Compendium XV, page 287.

[143] Compendium XV, page 288.

factory results could be obtained, but in none of these was there any claim as yet that steel of a quality equal to the open-hearth was available by this oxygen to surface process.[144] Thirty tests up to then had been performed.[145] Still as of the completion of the thirtieth test, the Linz experimenters gave no indication that they had arrived at a process which was either patenable or **[83]** available for industrial uses.

What I am concerned with here is that the District Court accepted testimony from the patentees and concluded that the only two changes made in the June 25th tests from the June 17th tests and from the prior Durrer-Helbruegge testing at Gerlafingen, were the changing the Laval nozzle to a normal cylindrical nozzle and an increase in the nozzle bath distance from 10 centimeters to 15 centimeters.[146] By itself this conclusion would seem to be non-critical, but when it became associated with the inventor's "method" and what appeared to be the foundation for the eventual finding that "avoidance of deep penetration was the gist of the invention", upon which the patent was based, it became crucial if it was not indeed technically factual.[147] It is, therefore, important that we understand that the difference between the June 25th tests and the Gerlafingen experimentation, or even that of the prior art of Schwarz and Miles, may have been in the change of nozzle from a Laval type to a normal type, and in the raising of the height of the nozzle from 10 centimeters to 15 centimeters, or in other words a lessening of impact pressure. The **[84]** extrapolation of these two differences to the patent itself is unfounded as being nowhere related in the evidence of the case at McLouth. Furthermore, from an examination of the patent

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[144] Compendium XV, page 289.

[145] Compendium XV, page 289.

[146] Compendium XV, page 291.

[147] Compendium XV, page 295.

itself it will be seen that neither of these two changes are mentioned in the patent. Neither did it take into consideration the fact that other differences existed from the prior art, that the nozzle was inserted at the top center and as the vessel straightened, it became approximately vertical and centrally directed.[148] What the District Court also failed to consider and discuss were that additional 220 tests were carried out and concluded as of November, 1950. It will be seen that by reason of all these tests up to November, 1950 neither of the differences or changes concluded by the District Court to be the gist of the invention in the patent were stated in the patent, or bore any materiality or relevance to the specification prescribed in the patent applications as they were presented to the United States Patent Office.[149]

[85] What is noticeable, however, in reading the patent is that it provides detailedly for a series of instructions on using and making the process, which were not even mentioned or discussed in connection with the June 25th tests. From a reading of the Suess specification and of an understanding that it does produce the results which it promises of procuring a quality of steel equal to that obtained from the open-hearth it is evident that the patent provides the correlated ingredients which comprise the "method" of the subject matter as in effect a combination process.[150]

It would seem then that the District Court did not correlate and differentiate the method of the June 1949 Suess experimentation from the Gerlafingen experimentation as the testimony purported, but rather from the patent specification itself, and so arrived at the conclusion that the only difference of the Suess patent from the prior art was one of "lower impact pressure".[151] Therefore,

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[148] Compendium XV, page 290.

[149] Compendium XV, page 290.

[150] Compendium XV, page 295.

[151] Compendium XV, page 302.

while Drs. Hauttmann and Trenkler testified to the two main physical or mechanical differences in early Suess tests at Linz of a change from a Laval nozzle to a regular nozzle and of heightening it, it held no support for the [86] District Court's finding that it was the invention for which the patentees made application in the United States Patent Office and upon which applications a patent was eventually granted. Yet it might also seem possible that, if the District Court misread the stipulation as having movement or circulation induced physically or mechanically by the oxygen jet, that it could be easily convinced by these two changes in the early experimentation at Linz, that such physical changes could support its interpretation of the stipulation to that effect, and its eventual finding that adjustment of the impact pressure of the jet contributed or caused an "avoidance of deep penetration which was the gist of the invention." [152]

[87] **The Plaintiffs' Final Argument**

The District Court said that the "plaintiffs also admitted on final arguments that the only mechanical changes in method from the teachings and disclosures of Dr. Durrer and Dr. Hellbruegge were the change from a Laval to a normal nozzle and an increase in the nozzle bath distance." This may be a highly critical factor which I must consider in the light that it was a potential inducement guiding the District Court into the thinking that reduced impact pressure of the jet upon the bath produced the avoidance of deep penetration, and eventually was the gist of the invention.[153]

The testimony of certain witnesses that the only physical change between the June 17th and June 25th series of tests at Linz was that from a Laval nozzle to a normal nozzle and that of increasing the nozzle bath distance from 10

[152] Compendium XV, page 304.

[153] Compendium XVI, page 306.

centimeters to 15 centimeters occupied considerable time in the plaintiffs' final arguments.[154] At times in this argument the statements of counsel for the plaintiffs would seem to support the District Court's statement that "plaintiffs also admitted on final arguments . . ." [155] However, I cannot stop here because, first, the District Court disregarded more than 200 tests which were conducted after June 27th by the Suess patentees, and second, that what counsel for the plaintiffs was saying or trying to say [88] about the patent itself is revealing. We know that the so-called changes from the prior art and the June 25th tests were not incorporated in the Suess applications filed in the United States Patent Office.[156] And because counsel for the plaintiffs, who was trying to be submissively respectful to the District Court, was unable to get in the points which clarify the difference between the prior art and the Gerlafingen experiments with the eventual Suess patent process applications. As for instance, counsel said at one time during the arguments:

> "I want to make myself clear on this matter of the new mental concept. I'm not suggesting, your Honor, that we have here a patent on just a mental concept, because what we have is a process patent. We have in the specification a description of the process, and we have in the claims a statement of the considerations, the guidelines, the steps that have to be carried out in order to accomplish results sought by the inventors." [157]

On another occasion he said:

> "The bath movement should not be caused by the mechanical action of the oxygen jet but by the chemical reactions which take place . . . the desirability of creat-

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[154] Compendium XVI, page 306.

[155] Compendium XVI, page 306-308.

[156] Compendium XVI, page 309.

[157] Compendium XVI, page 309.

> ing a hot spot—that is, a highly reactive zone—in the central portion of the surface of the bath and in the upper region of the bath which is spaced from the refractory lining of the vessel—that is, from the walls and from the bottom." [158]

[89] While counsel did attempt to impress the District Court with the fact that the new concept included the physical necessity of the "lowering of the impact pressure of the jet on the metal bath", he also attempted to explain that this one phase of the concept created the extremely high temperatures in the localized reaction zone and prevented the "burning of the refractories, and at the same time eliminating the phosphorus by blowing contrary to what prior art believed had to be done by blowing deeply into the bath." [159]

At another time when the District Court said it was not enough to say you are going to blow so as to avoid all these things if you don't teach how to do it, counsel replied,

> "That is what the specification is for, and that is just what the specification does." [160]

At another time, he said:

> "No. I think that the claim sets forth the method, your Honor. And I think that how to do it, within the broad considerations, the broad principle specified in the claim, the specifications tells everybody in the arts just what to do" [161]

[90] On still another occasion counsel referred to the examples and the "exemplary commercial practices" set forth in the patent.[162] On still a different occasion he stated that

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[158] Compendium XVI, page 310.

[159] Compendium XVI, pages 310-311.

[160] Compendium XVI, page 312.

[161] Compendium XVI, page 312.

[162] Compendium XVI, page 314.

> "the mental conception of the method of operation is the important feature, and that that mental conception, which is *reduced to the process steps* which are set forth in the claims, is the thing which resulted in a new mode of operation which had brought about these important and far-reaching consequences." (Emphasis added)

What is important is that counsel did, at various times, attempt to set out the various features or factors of the Suess patent, which differentiated it from the prior art; such as the avoidance of the stirring action in the bath as practiced in the prior art; [163] the vertical blowing in the Suess patent as against angular blowing in the prior art [164]; the ratio of bath depth to surface area.[165]

[91] It seems to me from an examination of the entire final argument with plaintiffs' counsel, that plaintiffs' counsel was trying to make clear to the District Court the difference of what was conceptual to the Linz experiments in June 1949, and what had become conceptual to them when they filed the application for patents both in Austria and in the United States. The patent application and the continuation-in-part applications show an enormously patentable different between the June, 1949 experiments at Linz and the eventual contents which were incorporated in the patent application.

Counsel made a remark in this connection:

> "You must not forget that this particular art was in an embryonic state at the time that these people wrote some of these things in the early days, because they didn't fully understand the chemistry involved, or at least I don't believe they did. They did an admirable job, however, when it came to filing their applications and pointing out what this real new concept was . . ." [166]

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[163] Compendium XVI, page 315.

[164] Compendium XVI, page 315-316.

[165] Compendium XVI, page 316.

[166] Compendium XVI, page 326.

[92] From a reading of the applications, it is readily apparent that they do not contain the words "Laval nozzle" or "heightening the nozzle" from the bath surface of 10 centimeters to 15 centimeters, but yet it would seem even as of January 1951, when the patent application was filed, the scientific theories were not yet understood. As for instance, it is shown by the statement in the specification that "It is believed" that the circulation occurs in a particular way, and yet while it is not required that patentees must know the scientific principle by which their patent works, how is it possible to condemn counsel if he, in fact, has such a deficient knowledge of the scientific functioning of the patent which he is sponsoring for his client? This is true, became I, by hindsight, now realize that counsel for the plaintiffs might have pointed to much in the specification for answers to the District Court's questioning on what the process is and how it is believed to function.[167]

On the basis of the various colloquies I got the impression that the District Court was relying less upon what was contained in the Suess patent and more on what it deduced from the testimony of the various witnesses. So while the specification tells the steelmaker how his process is functioning, it does not tell him **[93]** in *totidem verbis* to avoid deep penetration, since he would be doing that by just following the instructions in the specification. Thus, while the District Court was inspired by the fact at this stage of the case in the final argument that "the aspects of the invention necessarily follow from avoidance of deep penetration", it is obvious from a reading of the entire specification that this was fallacious; because we see that the specification's teachings of limitations of blowing pressure, vertical and central blowing, together with the other instructions, are abundantly and particularly set out and explained. The law does not demand anything more than this.[168]

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[167] Compendium XVI, pages 327-329.

[168] Compendium XVI, pages 332-333.

Because the District Court in the plaintiffs' final argument dwelled upon the idea that the change from the prior art of nozzle difference and placement as it avoided deep penetration and was therefore the gist of the invention, I must carefully examine the record to ascertain whether the plaintiffs provoked or caused this thinking as against the plainly stated words of the specification. And yet I have the idea that the District Court was informed on several factors of the Suess process. On one occasion, the District Court said, ". . . I suppose, that all of the other aspects of the invention necessarily follow from the avoidance of deep penetration?" Counsel for the plaintiffs replied, "I don't think it can be simplified to [94] that extent, your Honor, because of the possibility that somebody would be able to blow and cause the oxygen jet to cover, we will say, the entire area of the bath. That is not covered by our patent. But I doubt very much that anybody could do that and make good steel."[169]

So, too, when counsel stressed the necessity for an appropriate contact between the oxygen jet and the metal, in order to create the localized reaction zone, it seems to have made no impression upon the District Court, because it eventually ruled that the word "below" and "localized reaction zone space a substantial distance from the refractory lining" could exist even with deep penetration as taught by the Schwarz and Miles patents.[170] Thus the District Court Opinion would seem to indicate that during final argument with plaintiffs' counsel, there was a gap in the thinking as to the chain for technically comprehending and understanding what the Suess process was and the seemingly sidetracking of it to what it was not, i.e., a practically one step physical manipulation of the oxygen jet so as to lessen impact pressure.[171]

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[169] Compendium XVI, page 334.

[170] Compendium XVI, page 335.

[171] Compendium XVI, page 335-336.

So that when counsel for the plaintiffs attempted to **[95]** explain that "avoiding material agitation of the bath by the oxygen stream" also "embraces . . . this matter of avoiding deep penetration . . .", it lent no persuasion to the District Court because it (the claim) "doesn't use that language".[172] Other similar examples appear in the record.

Counsel made efforts for clarification of what the Suess process was intotality yet he was unable to do so. I am earnestly of the belief that the assumed riddle which the District Court evolved from the thinking that the plaintiffs had contended that a 1 unit of physical or mechanical force-power could overcome a 3000-8000 units of chemical force-power and by the erroneous conclusions which it had deduced from the Ann Arbor demonstrations, particularly Nos. 7 and 9,[173] was because the District Court seemed to have relied more on what the expert witnesses said than on what the specification itself said, and yet what it corroborated by the fact that it affirmed its belief in the invention and that it was capable of being accomplished by persons skilled in the art of steelmaking.[174]

[96] Dr. Trenkler and Dr. Hauttmann did say that in their early experimentation in June 1949, there were the two changes of nozzle and of nozzle bath distance. Also, that these were changes from the prior art of Schwarz and Miles, and that these two changes did not become as such features in the application for patent rights by Suess. We are informed that there were approximately 250 tests required for ascertaining the circumstances necessary for such a working process, and that although the experimenters got good steel with the June 25th series of tests, there is no

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[172] Compendium XVI, page 336.

[173] Compendium XVI, page 338-339.

[174] Compendium XVI, page 339.

evidence in the record that either experimentation process of June 25th, 1949, or quality of steel which it produced were either the process of the patent application or of the character of steel which was eventually desired to be achieved and was achieved, that is, steel of open-hearth quality.

My inquiry shows that counsel for the plaintiffs did feature avoidance of deep penetration as the "new concept" and as differing from Schwarz and Miles, as well as from Durrer and Hellbruegge. It also shows that plaintiffs' counsel while featuring the avoidance of deep penetration put on a "selling campaign to the District Court of 'reduced impact pressure of the jet on the bath so as to avoid deep penetration" and that he [97] in very great likelihood oversold the feature at the trial. However, the inquiry shows that the plaintiffs' counsel did not advocate "avoidance of deep penetration" or reduced impact pressure" as the exclusive feature of the Suess process, although he spoke less of these. My inquiry shows that he did attempt to advocate "deep penetration" and "heavy impact pressure of the oxygen jet" as prior art devices required for stirring the bath. However, it may not be said that plaintiffs' counsel did not attempt to advocate vertical blowing as against angular blowing of the prior art, central surface blowing as against the non-specified blowing of the prior art, of ratio of bath depth to surface area requirements, of prescribed limits within which pressure was to be applied, and of prescribed height distances within the limits as set forth in the specification, all for the purpose of procuring a "localized reaction zone" at the center surface of the bath to bring about chemical circulation as against mechanical jet circulation. All these and more were the instructions contained in the specification. None of these found meaning, since no finding supported their existence in the District Court Opinion.

[98] So it is that while the Opinion credits Dr. Trenkler, Dr. Hauttmann, and plaintiffs' admissions on final argu-

ments, to the effect that there were only two changes, that from a Laval to a normal nozzle and an increase in nozzle bath distance from the prior art, such findings have no connection, in so many words, with or effect upon the patent's specification. The District Court Opinion attempts to make that connection by finding that the original changes in June 1949 from Dr. Durrer and Dr. Hellbruegge of a nozzle and of a nozzle bath distance were the changes which provided "a reduced impact pressure of the jet on the bath so as to avoid deep penetration"; that "such avoidance of deep penetration" "'was the new concept, the new mental approach' of the patentees",[175] and that such maximum limit on penetration appears to this Court to be the real gist of the invention by the patentees . . ." [176]

Thus, it would seem that the admissions of Dr. Trenkler and Dr. Hauttmann, as well as of the plaintiffs, including the advocacy of plaintiffs' counsel, were not in reality the moving cause for the District Court Opinion's finding that the new invention existed only because of the lowering of the impact pressure.[177]

[99]

Oxygen

The District Court asserted that it was "unable to fix with certainty any date on which oxygen became available inexpensively in large quantities for commercial production of steel." The Court of Appeals accepted this statement of the District Court and assumed "that the lack of commercial quantities of oxygen would affect the quality of the disclosures in the prior art on matters such as specific commercial operating conditions, demonstrative examples and the like . . . The commercial unavailability of oxygen would explain the absence of any prior attempts to apply the

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[175] Compendium XVI, page 348.

[176] Compendium XVI, page 348.

[177] Compendium XVI, pages 346-349.

Schwarz and Miles patents and would thus weaken any inferences that such a lapse in the industry might raise on the issue of obviousness." [178]

The District Court had before it a number of defendant's witnesses who made various statements. Drs. Durrer and Hellbruegge had been working on oxygen smelting on an industrial scale before January, 1941. Dr. Hellbruegge stated that in the late 1930's adequate quantities of oxygen were available for experimental work, and as of such time commercial quantities of oxygen were not required.[179] Dr. Hellbruegge stated that large quantities of oxygen were available in 1940.[180] In 1928, [100] Dr. Fraenkl discovered a process of extracting oxygen from the air on a tonnage quantity basis. The discovery became known as the Linde-Fraenkl process. Dr. Durrer said that this process made it cheaper and available for them in the metallurgical processes.[181] Another defendant witness, Lyle J. Johnson, Vice-President of Engineering of McLouth, said that as of 1940 there were a number of tonnage oxygen plants which had been constructed suitable for this type of use.

With this evidence before it, the District Court could have made a finding that there was or was not oxygen available for industrial use on and after July 3, 1943, when the Schwarz patent was published. Recognizing that the Second World War ended on September 2, 1945, and that the free world might not have had access to such Schwarz patent until after the war, it was nevertheless evident that any bare "conflicting evidence" arose between the defendant's own witnesses not from anything which the defendant's wit-

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[178] Compendium XVII, page 352.

[179] Compendium XVII, page 352.

[180] Compendium XVII, page 353.

[181] Compendium XVII, page 353.

nesses contradicted in the plaintiffs' testimony. Under these circumstances, the defendant upon whom the burden [101] rested, did not present legal evidence that oxygen was unavailable for industrial use and purposes after the Schwarz patent issued.[182] Since this bears on the matter of unobviousness and utility, even though in a secondary sense, of the Suess patent as contrasted with the prior art, and since it involves a scientific factor on the question of novelty and invention as such, I deem it appropriate to inquire into this matter.

The Schwarz patent was allowed as of May 24, 1939 and made known on April 3, 1943. The Miles patent application was filed in the Kingdom of Belgium on October 4, 1946 and granted on November 30, 1946.[183] I considered that if the German patent was anywhere near as good as Dr. Schwarz said it was that the Government of Germany (and Schwarz was an employee of its steelmills) would have made as much use of it as its potentialities would have allowed for the war efforts. There is no evidence of such use.[184] Allowing for the fact that there was a letdown for steel after the war, there had been no letdown in steel production during the War in the United States. And common [102] knowledge has it that this country outreached itself in steel productions as spurred on by the war, even as they concentrated upon the construction and utilization of the atomic bomb by availing all scientific minds and energy from all parts of the world for its production. While this is not altogether a substantial comparison, the speedy procurement of steel from iron by the use of pure oxygen was well known from published reports emanating in this country, primarily from official United States sources and the American Iron and Steel Institute, as well as published reports in Europe, as I shall presently describe.

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[182] Compendium XVII, page 355.

[183] Compendium XVII, page 355.

[184] Compendium XVII, page 356.

If the theory was as utilizable as Schwarz contended in his patent as early as 1939—and even earlier from his experimenting with it—the method for obtaining pure oxygen had already been presented to these scientists as early as 1928. There is no evidence in the record that the means for procuring pure oxygen dependent upon anything more than building a plant to produce it from the air. From the record it is apparent that a number of plants were already in production of pure oxygen and **[103]** that these plants were dispensing it in bottles and transporting it to the users. The question arises, if the Schwarz patent was as good as it claimed, why would not the H. A. Brassert & Co. of Berlin, Charlottenburg, by whom Schwarz was employed, have erected the necessary oxygen plant in the place of the manufacture of steel. That the Company did not do so raises the presumption that the Schwarz patent was not within the competence to produce as it claimed.[185]

Up to the time of the Suess patent, it would seem that oxygen had its use only in the laboratory, and thus procuring it in transported bottles from the oxygen plant, was the convenient and economical way to do. I am reminded of the early use of oil in the United States, when its prime purpose was for furnishing kerosene to light lamps, grease to lubricate wagon wheel axles, and other similar chores. So it seems in the early days after 1928, the first use of oxygen tonnage was really not for using the oxygen, but rather for separating the air for its nitrogen to be used as fertilizer, while the purified oxygen found practically no users at all. That is not to say that there was no experimentation going on both in Europe and in the United States.

[104] The fact that experimentation had been going on both in Europe and in the United States is set forth in published reports. As I stated previously, at my request the parties presented me liberally with an abundance of publi-

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[185] Compendium XVII, pages 356-357.

cations. Some of these are recorded as exhibits in the McLouth record. In the American Iron and Steel Institute (AISI) Yearbook, 1920, we learn that Carl Linde of Munich and Georges Claude of Paris had innovated the commercial development by which air was separated into nitrogen and oxygen by liquefaction and distillation; that its cost was from $25.00 to $30.00 per ton; that the knowledge of its use was very narrow, primarily in the fields for cutting and welding, and that for these purposes bottle oxygen was sufficient. In the same publication, it was stated that the cost of oxygen depends directly on the use to be made of it. If there is no use for the oxygen, the matter of cost is without interest. But it did promise that the availability at an extremely low cost is now in sight and gives large promise of economy in steelmaking.

In 1923, a published report by the Department of the Interior, Bureau of Mines, said that ". . . the comparatively small demand for the product [oxygen] has prevented the installation of large units suitable for metallurgical processes . . ." It **[105]** stated that "large oxygen manufacturing plants can be built to serve metallurgical purposes directly, which, by virtue of their large production and correspondingly increased sufficiency, together with the fact that no compression in cylinders, storage, transportation, or service will be required will be capable of delivering oxygen for the processes at a cost not to exceed $3 per gross ton. In other words, the Committee finds that the oxygen industry is now able to make plants for supplying large quantities of oxygen to metallurgical industries at low cost." We remember that this was five years before the Fraenkl process came into existence in 1928.

During the years commencing in the late 1920's or early 1930's as the McLouth record discloses, a long list of named steelmen and more unnamed steelmen were active generally in the field of application of oxygen to metallurgy.[186]

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[186] Compendium XVII, page 360.

[106] In June, 1924 a report published by permission of the Director, United States Bureau of Mines, repeated that large manufacturing plants can be built to serve metallurgical purposes at a cost not to exceed $3 per gross ton.[187] Russia attempted blowing enriched air and pure oxygen into a Bessemer converter in 1945, but procured a poor quality of metal and the wearing out of parts "in view of strong overheating of the bath".[188]

In 1948, J. H. Zimmerman, Manager Development Division of the Linde Air Products Company, in the Iron and Steel Engineers Yearbook, indicated that over 6,000 heats using oxygen in some 34 furnace shops in which the majority had availed high purity 99.5% oxygen, were "supplied from existing liquid oxygen systems because of its availability in substantially large volumes and ability to serve high demand rates."[189]

A. G. Robiette, a Director of John Miles & Partners (London) reported on the results of experiments, started during the late war years, about 1945, when an electric furnace used about 90% oxygen. He also reported that two production size plants were [107] going up in Sweden for the use of this process, as well as one in France and one in England. He did not report on the unwanted elements contained in the finished product or of the condition of the refractories in their "actual pilot scale experiments".[190]

In 1948, Dr. W. M. Pollitzer, Technical Industrial Intelligence Division, Department of Commerce, told of the building of a blast furnace for experiments with oxygen enriched air in 1933. The experiment used more than 26% enriched oxygen air and was found to be unsuccessful. Dr. Pollitzer

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[187] Compendium XVII, page 359-360.

[188] Compendium XVII, page 361.

[189] Compendium XVII, page 361-362.

[190] Compendium XVII, page 362, 370.

also told of the building of a plant at Trostberg in Eastern Bavaria for the purpose of utilizing "cheap oxygen", because the Linde plant was manufacturing nitrogen as fertilizer and leaving the oxygen as a by-product for which there was little use.[191]

During World War II, the United States produced in conjunction with the National Defense Research Council "together with the technical talent of this country" portable and stationary oxygen plants for use in the Pacific on shipboard and at other battlefronts. After discussing its use for the production of iron and steel and the cost he arrived at the figure of $3 per ton of oxygen.[192]

[108] In approximately 1946, the Weirton Steel Company installed several small pure oxygen plants for the production of 99.5% oxygen for general steel plant use.[193] Since the year 1945 the international demand for steel had been expanding and with it the use of oxygen, accordingly metallurgy, had also become more a matter of interest. The developing steelmarket stimulated the introduction of technics designed to increase production.

And yet Schwarz in a paper published in 1949 introduced into the McLouth record, ten years after he had filed for the German patent and six years after it was published, discussed the use of oxygen blowing in a Siemans-Martin and Electric furnace, as well as to blast furnaces. In any event, I noted particularly that he did not discuss the Schwarz patent as it might have been experimented upon or utilized in the metallurgical industry during the years under discussion.[194] He also discussed the oxygen installa-

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[191] Compendium XVII, page 363.

[192] Compendium XVII, page 364.

[193] Compendium XVII, page 364.

[194] Compendium XVII, page 366.

tions at the Weirton Steel Company and the make-up of costs and amortization as being $8.82 per ton.[195]

In 1952 Dr. Schwarz presented another report which was introduced into the record as another exhibit. As I observed from what Schwarz reported in the two papers, he never claimed that [109] "good steel" was produced by "blowing of basic Bessemer pig iron with a free jet lance".

In close relation to the Schwarz report, I examined a second report by A. G. Robiette presented before the Norwegian Metallurgical Society on April 26, 1948 in Oslo. He talked about various applications of oxygen which was made possible by the developments of cheap oxygen by Linde-Fraenkel and other systems. He said that these had "so reduced the cost of oxygen that it can now be seriously considered both for combustion systems and for the refining of pig iron and the production of steel." It is noticed that he made no enthusiastic discussion about the Miles patent.[196]

In the reports both of Schwarz and Robiette I particularly noticed that there were no complaints as to oxygen unavailability for industrial application.[197] Thus from the exhibits produced in the McLouth record and these historically published reports, oxygen was available not only for experimentation but as well for manufacturing purposes—if any process of direct oxygen application to blast furnace or pig iron, particularly that of Schwarz and Miles, had a workable process. It is noticeable, too, that no steelmen rushed to either the doors of Schwarz or Miles and adopted [110] their processes. This is some evidence that the processes of both Schwarz and Miles were not workable and productive as claimed. So that from the

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[195] Compendium XVII, page 367.

[196] Compendium XVII, at page 369.

[197] Compendium XVII, at page 370.

early 1940's, it was possible to build a plant for the industrial application of oxygen and no unusual occurrences took place until 1951-1952, when the Linz plant was established for tonnage oxygen to be used directly in iron to steel conversion.

When Carl Linde and Georges Claude had prior to 1920 conceived the idea of extracting oxygen from the air, and making it available in bottles for storage and transportation, it was not until 1928 that Fraenkl introduced the method of making tonnage oxygen available on a large scale. At that time in Germany, the Linde-Fraenkl plant was established and in other places including the United States, a large number of plants produced oxygen and made oxygen available for scarfing and oxyacetylene uses. The early thought was in attempting to enrich the air which was introduced into blast and Bessemer furnaces for speeding up the steel process. However, too many disadvantages arose which made it impractical. After the Linde-Fraenkl process was divulged, the United States Government procured portable oxygen-making plants [111] which it used during the Second World War. In West Virginia, the Weirton Steel Company had established a plant in 1946. In Germany, Dr. Carl Schwarz of H. A. Brassert & Co. was issued a patent on surface application of oxygen to molten metal but as late as 1949, it is obvious that Dr. Schwarz had not yet arrived at a practical method of industrial steelmaking. In 1943 and 1946, John Miles of the John Miles & Partners (London) Limited, a steelmaking company in Great Britain also was issued a patent, but it is apparent from a director of that company, one Robiette, that the Miles process was still in its experimental stages. In any event, it is apparent that "relatively cheap oxygen was available as early as 1930, either as evaporated liquid or from tonnage plants". It was also true that oxygen plants were being constructed and could be constructed at the sites of steel mills for cheap tonnage oxygen. However, while nitrogen was being recovered for use as fertilizer by this method, no substantial use

for the cheap oxygen by-product had been as yet discovered. While the later war years and post-war years found a lag in the steelmarket demand, experimentation continued on oxygen utilization in the steel industry. Both Schwarz and Miles, connected **[112]** as they were with steel manufacturers, also continued experimentation, but neither were instrumental in bringing about an oxygen steelmaking plant in accordance with their patented processes. Neither, in published papers, claimed anything more than experimentations; and neither claimed that they had insufficient available oxygen for making their process workable. So that while in the early 1940's it was possible to build a plant for the industrial application of oxygen, yet no unusual occurrence had taken place up until 1951-1952, when the Linz plant was established for tonnage oxygen to be used directly in iron to steel conversion.

From the viewpoint, then, that the cost of installing the oxygen mill with the use of a vessel capable of being inclined on a trunion, and for the economical recovery of high quality steel from iron in a matter of 20-30 minutes as against eleven hours under the open-hearth method, the cost of the oxygen which prevailed during the 1940's would have proved no hindrance to any who wished to follow the Schwarz or Miles patents. In any event the McLouth record is devoid of legal proof bearing upon prior art obviousness and utility in derogation of the Suess et al. patent.

[113] **The Court of Appeals**

The Court of Appeals accepted a great deal of the conclusions made by the District Court, but the most critical of these was that "avoidance of deep penetration was the [subject matter and] gist of the invention." I firmly believe that if the finding had not been made by the District Court that "avoidance of deep penetration is the gist of the invention," the Court of Appeals would not have been misdirected as to the scientific facts.

In examining the Opinion of the Court of Appeals it will be seen that no place does it mention why it accepted this finding of the District Court and barely mentions the mechanical or physical aspect which the District Court found to be an invention—that is, the "reduction of impact pressure" as the Suess inventive discovery.[198]

Although the Court of Appeals affirmed the ultimate determination of the District Court on the grounds that the patent overclaimed the invention and covers prior art, and that while it said that it was "unnecessary to consider the correctness of every ruling of the District Court," it nevertheless did comment on a considerable number of the District Court's findings.

[114] It correlated avoidance of deep penetration as "the direct antithesis of the thinking then prevalent in the steelmaking art" and concluded that this raised "other problems of defining exactly what novel element the patentees claim and how that novel element might be meaningfully distinguished from the prior art."

The Appeals Court asserted that "avoidance of deep penetration" was an abstract phrase and could "gain meaning only from the limitations placed upon it by the patent and from the knowledge that may be attributed to an ordinary worker skilled in the art." [199] It then made a series of conclusions, holdings and findings.[200]

1. As for the holding by the Court of Appeals that the District Court's conclusion of non-obviousness was based entirely upon secondary considerations of long-felt but unsolved needs, I refer to what I said in Compendium VXII, page 360 and Compendium XVIII, page 383, that thirty named and a number of other unnamed experimenters were

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[198] Opinion Compendium XVIII, at page 374.

[199] Compendium XVIII, at page 376.

[200] Compendium XVIII, at pages 378-385.

at work with oxygen in steel plants. Whether these indicated the long-felt needs may be questionable; [115] that its was an unsolved need is unquestionable, particularly as was testified to by the defendant's witness, Dr. Durrer, and the plaintiffs' witness, Dr. Hauttmann, without contradiction that not only Gerlafingen test results, but also Schwarz and Miles, produced no commercial quality products. However, this testimony was for secondary consideration, but as secondary consideration, it would be admissible as evidence under *Graham* v. *John Deere Company, supra,* where non-obviousness becomes an issue of fact.

2. As for the holding by the Court of Appeals that it did not have the benefit of a complete determination of the difference between the prior art and the patent in suit, or any findings concerning the level of skill in the pertinent art, there is first of all admittedly no evidence in the McLouth record that steel with satisfactory content was made commercially by anyone in the 1940's using the oxygen blowing process, despite the extensive experimentation which was carried on by these oxygen-steel experts.[201] Also, the District Court made these distinctions: (1) prior art produced objectionably high phosphorus content in the steel and caused refractory damage;[202] (2) the prior art [116] teachings of Schwarz did not teach "the avoidance of material agitation of the bath by the oxygen stream or a circulation of the bath produced by chemical reactions in the localized reaction zone as claimed by the patent in suit"[203]; (3) the District Court recites the differences in the Miles patent and the patent in suit[204]; (4) the District Court Opinion differentiates with considerable detail and charts the prior art products at Gerlafingen which practiced the

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[201] Compendium XVIII, at page 384.

[202] Compendium XVIII, at page 384.

[203] Compendium XVIII, pages 385-386.

[204] Compendium XVIII, page 386.

prior art of Schwarz, did not produce high quality of steel and did not preserve the refractory life in the vessel as against the chemical content at Linz, particularly in the June 25th tests[205]; (5) the Schwarz patent, unlike the patent in suit, does not teach specific operating conditions.[206] As against the prior art patent, the Suess patent provided instructions which could be followed by persons skilled in the art to make satisfactory steel and could be extrapolated for various operating conditions for larger heat sizes.[207]

[117] 3. The Court of Appeals found that the District Court found three considerations dispositive on the issue of obviousness: (1) presumption of validity; (2) the commercial success of the basic oxygen process; and (3) secondary considerations concerning prior attempts and failures of oxygen steel refining. As for the presumption of validity which the statute gives to a patent when it is issued by a patent office, although it is not conclusive, yet it does according to the Supreme Court give the grant of a patent substance and value. Thus, the very issuance of letters patent is prima facie evidence of validity.[208]

Although the Court of Appeals recognized and accepted the District Court's inability to determine when commercial quantities of pure oxygen became economically available and stated that it "would explain the absence of any prior attempts to apply the Schwarz and Miles patents . . . and thus would weaken any inferences as such a lapse in the industry might raise on the issue of obviousness," there is abundant evidence in the record from McLouth's own witnesses, Lyle Johnson, Vice-President in charge of Engineering, Dr. Durrer and even the prior patentee, Dr. Schwarz, that oxygen was available and that no efforts were

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[205] Compendium XVIII, page 386.

[206] Compendium XVIII, page 386.

[207] Compendium XVIII, page 387.

[208] Compendium XVIII, at page 390.

[118] made to industrialize the Schwarz process application of iron to steel during the years 1940 through 1952. Furthermore, none of the experimenters, including Dr. Schwarz, Dr. Durrer, Dr. Hellbruegge and others ever complained that oxygen was unavailable on a tonnage basis, by the construction of a plant, at the site where it was to be used for refining of iron.[209]

4. As for the finding by the Court of Appeals that the failure of the Patent Office to cite the Schwarz patent significantly weakened the presumption of validity,[210] it is noticeable that the Court of Appeals admitted hat there was "mention of the Schwarz patent in the file wrapper as contained in the affidavits of Rinesch and Hauttmann" but it gave no weight to these affidavits because they were filed late and "submitted to the Patent Office and filed somewhere obscurely in the file wrapper history of the patent."[211]

[119] In spite of the fact that Patent Office rules require that "no attention will be paid to any alleged oral promise, stipulation or understanding in relation to which there is disagreement or doubt,"[212] the filing of the Hauttmann and Rinesch affidavits by the Suess applicants made them a part of the file wrapper history and as such, as much a part of the file wrapper history as any other paper. Furthermore, the rule of the Patent Office grants applicants the right to interviews.[213]

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[209] Compendium XVIII, P. 393; See Compendium Oxygen XVII, 360 page ——, where the record shows that at least 30 individuals were engaged in experimenting to find a "remedy or a resolution" of their problems of applying oxygen directly to molten iron and producing an industry acceptable steel, while at the same time avoidance the destruction of the refractories.

[210] Compendium XVIII, pages 394-395.

[211] Compendium XVIII, page 395.

[212] 37 C.F.R. 1.a.

[213] 37 C.F.R. 1.133.

[120] And yet the file wrapper history in this case is not devoid of a recording of the discussion with the examiner on May 1, 1957. This reads as follows:

> "Claims of the application are cancelled and new claim 17 and 18 are substituted therefor, in view of the discussion with the Examiner on May 1, 1957.
>
> The new claims are presented in view of information recently made available and which indicate that the instant application discloses a fundamentally different approach to the refining of pig iron or crude iron by means of substantially pure oxygen and was suggested heretofore. The new claims are believed to be properly definitive of the invention." (PX2A, at page 74)

Similarly there is a recording in the file wrapper history with a reference to Schwarz.[214] That is was considered by the Patent Office is verified by an explanation requested of the applicants of the obviously high phosphorus value and for which a cablegram was received as was stated in the file wrapper history.[215] In the Hauttmann affidavit as filed, both the Schwarz and Miles patents were mentioned in two places.[216] Thus it would seem that the file wrapper is not "void" as to the content of the discussion with the Examiner on May 1, 1957.[217]

[121] In this respect I am of the opinion that the Court of Appeals was misguided by the original findings of the District Court that "reduction of impact pressure" was the "avoidance of deep penetration [which] was the gist of the invention." Thus, if the McLouth District Court did misinterpret the specification and arrived at the conclusion that the specification stated that the oxygen jet physically or mechanically produced circulation in the molten bath, and

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[214] Compendium XVIII, page 398.

[215] Compendium XVIII, page 399.

[216] Compendium XVIII, page 401.

[217] Compendium XVIII, page 403.

thereafter made its determination that the adjustment of the oxygen jet was the invention by the avoidance of the deep penetration of the bath—and as such was the gist of the invention—is accepted and followed by the Court of Appeals rather than as viewing this as the intermediate result of the instructions contained in the Suess specification and a caution to the operator, then the original misinterpretation of the District Court would have become threaded into the thinking of the Court of Appeals and the technological comprehension of what was stated in the specification would inequitably result.

There is further proof before me in the record in the first post-trial hearing from Claude A. LeRoy, the Primary Examiner, that the language contained in the affidavits was considered and acted upon by the Patent Office.[218]

[122] 5. As relates to the holding by the Court of Appeals that the Schwarz patent does not teach agitation of the bath by the oxygen stream, I refer to the Schwarz direction for introducing the jet of gas "with such a high kinetic energy that it is capable of penetrating in the manner of a solid body deep into the bath . . ." Thus, while Schwarz does not say in so many words that the jet is to circulate the bath, it could not be presumed that a solid body into the bath would do anything but disturb the bath as a huge spoon would agitate or stir it.[219]

[123] 6. The Court of Appeals found that there could be no competitive action on industrial functioning on the Schwarz patent because VOEST had tied up all of the steel companies into an association known as BOT. As of the time of the agreements, the record indicates that all of the companies, both in Europe and in the United States were experimenting with oxygen application to iron processing, but that none of them had perfected a use for processing

[218] Compendium XVIII, at page 405.

[219] Compendium XVIII, page 407.

by surface blowing on an industrial scale or level. A series of letters and agreements was made a matter of record in McLouth and that four companies Rollsche Eisenwerke, Gerlafingen, Mannesmannwerke Huckingen, Vereinigte Osterreichische Eisen-und Stahlwerke AG, Linz, and Osterreichische-Alpine Montangesellschaft, Vienna, agreed to exchange experience in the field of metallurgical use of oxygen in iron and steel plants, such as coke blast furnaces, electric blast furnaces, in melting processes involving converters, open-hearth furnaces and electric furnaces as well as in other metallurgical processes.[220] **[124]** However, there was no agreement on more than a mutual sharing of each others acquired information in their experimentations with oxygen, but there was no agreement on any competitive or monopolistic exclusion of the other steelmakers. However, it will be noticed that these agreements did not prevent anyone of them from building and utilizing Schwarz and Miles patents, if in fact Schwarz and Miles had had a successful and utilizable process of oxygen for steel conversion application. The very fact that they did not do so, and the very fact that they were still experimenting as late as 1952, is some evidence of the fact that neither Schwarz nor Miles had a utilizable industrial instrumentality in their processes. And yet even though the factual considerations are secondary, they must be read in their factual settings as they may or may not aid a just and equitable determination of the questions before me.

7. As relates to the finding by the Court of Appeals that the record does not disclose any extensive attempts and failures to refine steel by deep blowing of oxygen between 1946 and 1949,[221] the McLouth record when closely examined reveals an abundance of **[125]** attempts (and failures) as was disclosed and discussed in a part of this

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[220] Compendium XVIII, page 408.

[221] Compendium XVIII, page 413.

Opinion Compendium XVII dealing with the oxygen availability.

8. As relates to the holding by the Court of Appeals on the related topic on whether or not the success of the Suess process may be attributable to the disclosures in the Suess patent is unclear because of the arrangement between the four steelmakers of exchanging know-how and engineering knowledge, in addition to what I have set forth here under 6, I should state that the record discloses that there was considerable jealousy not only among the competiting steel companies, but even among the participants at Linz. I had indicated elsewhere that Dr. Durrer was not beneath showing his jealousy of the Suess accomplishment even though he praised it, and as against Schwarz' patenting with whom he said he collaborated and that the Schwarz patent was his idea in 1937. I also indicated that Dr. Durrer, the defendant's witness, presented testimony which was more favorable to the plaintiffs in the McLouth case than it was to the defendant.[222]

[126] 9. Assuming nevertheless that success of the Suess patent was unclear such as to those who purchased its know-how, the purchasers would, nevertheless, have had available to them the Schwarz and Miles patents. Yet nowhere in the record is there any showing of a rush by steelmakers to adopt the Schwarz and Miles process. While on the other hand the McLouth record is clear that an unmistakable rush of skeptical steelmakers came, saw and were convinced. These are circumstances which may be secondary evidence. Yet that the success of the process was attributable to the clear disclosure is obvious. The District Court's finding in this respect is substantially based. There is nothing in the record that shows that the success of the Suess process was incumbered by any understandings arrived at by the consortium of four steelmakers. Further-

[222] Compendium XVIII, page 414.

more, I discussed the report of Dr. Schwarz in 1949 and 1952, where he referred to the establishment at Linz of an oxygen steelmaking plant, and of the fact that in these reports Schwarz, himself, showed no real enthusiastic conviction for his own patent.[223]

10. The Court of Appeals was not impressed by the District Court's conclusion on inoperableness of the prior arts of Schwarz and Miles on the issue of obviousness because of the District [127] Court's assumption that "maintenance of a fluid slag was inconsistent with deep penetration as taught by Schwarz and Miles," and so the District Court interrelated this with phosphorus removal, fluid slag and depth of penetration as related to the "issue [of] . . . obviousness."

There is an abundance of evidence in the record that the injection of the oxygen within the bath produced the iron oxides within the bath and the high temperatures with it; that this lacked contiguity with the slag, which because of insufficiency of iron oxides in its contents, could not react upon sulfur and phosphorus. Efforts by Schwarz and Miles to produce iron oxides and preserve them within the bath, rather than to lose the iron to the slag, prevented sufficient iron oxides to move into the slag for reaction with sulfur and phosphorus. Thus the steel produced by these prior processes was of poor quality because of such unoxidized impurities. Additionally, the prior art process did not save the refractories and so both of these were a problem of the prior art and their experimenters until the Suess process solved it. The Suess solution, then, was nonobvious to the prior art.

[128] Under the scientific facts as abundantly produced in evidence it cannot be said that the District Court "assumed," rather the record discloses the technological chemical phenomena involved in these various processes to have

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[223] Compendium XVIII, page 416.

been abundantly supported for a finding that phosphorus removal, fluid slag and depth of penetration are interrelated and that this had not been obvious to the prior art and the experimenters all of whom practiced and preached deep penetration of oxygen into the bath.

11. The Court of Appeals concluded that the patentees had the benefit of almost six years' experience in using the basic oxygen process "plus whatever information they might have obtained through the BOT arrangement" between the filing of the original application and the continuation-in-part application in 1955. As for the information received from BOT, as I have already discussed this here, the patentees received no benefits whatsoever except the advice of Dr. Durrer who believed in the oxygen process and encouraged them to pursue the experimentation in that direction.[224] Furthermore, an examination of the original application as filed in the United States Patent Office in 1951 and the continuation-in-part application filed in 1955, it will be seen that both of these are **[129]** practically identical. Also, an analysis of all the claims filed indicate that what information was revealed from the first through the eighteenth was such information as the applicants had already had as the 250th test in 1950. Since the continuation-in-part application describes the same invention as did the original application, it is legally sufficient.[225]

12. The Court of Appeals held that even though the Miles patent contained no specific teaching of "deep penetration," yet the District Court "implied such a teaching from the recommendation that the gas should be jetted at a supersonic speed." Semantically speaking, this may be correct, since the specific word "deep" was not contained in the Miles patent.

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[224] Compendium XVIII, page 418.

[225] Compendium XVIII, page 419.

In the McLouth record both sides used the words "deep penetration" in the sense that that expression was antithetical to Suess. Thus, deep penetration became a label of the prior art of Schwarz, Miles and the Gerlafingen experimenters. So that when the District Court made its findings that the gist of the prior art invention was deep penetration, and that the gist of the Suess invention was avoidance of deep penetration, it expressed the antithesis of what was prior art and what was the Suess art.

The Primary Examiner expressed it in the same way:

> "The deep language, the deep penetration, I thought, was well known in the art . . . It was well understood in the art that deep penetration meant a considerable distance **[130]** into the bath . . ." [226]

Semantically speaking, the word "deep" is a relative term and is extended by comparative and superlative of deeper and deepest. That the word "deep" does not mean to the bottom or to the utmost depth of a container or space in the cases before us it has a specific meaning which is applicable to the contrasting relationship of the prior art and the later non-deep Suess art.[227] Based upon these facts and definitions we understand that Miles indicated that it was not easy to inject oxygen "within the bath" because a large amount of it was lost in the process of attempting to inject it into the bath. Therefore, he suggested that the oxidizer be in the form of a liquid so as to give a greater force of penetration into the metal, and that this would serve to "circulate and agitate the metal and the slag." Schwarz suggested that the jet be introduced into the bath "in the manner of a solid body." [228]

I am reminded of the more homely uses for using the teaspoon in a cup of coffee, or the mixmaster for cake bat-

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[226] Compendium XVIII, page 421.

[227] Compendium XVIII, page 421.

[228] Compendium XVIII, page 423.

ters or the ice cream maker in "circulating and agitating" the mix and that the blades of the mixmaster and ice cream maker must be deeply **[131]** enough inserted to produce the circulating, agitating or stirring action.[229]

So it is that the deep penetration of the prior art saved the iron at the expense of retaining phosphorus and sulfur in the metal.[230] Whereas with the combination of instructions provided by the Suess specification and the creating of an indent or localized reaction zone at the top central surface of the bath upon impingement of oxygen with the metal, chemical oxidation or reaction occurs at the place of impingement, and so as this specification explains "produces a sufficiently high reaction velocity of the oxygen with the bath constituents to insure the development of autogenous heat . . . consistent with controlled temperature and control and development of other necessary and required process conditions, such as fluid slag, avoidance of over-oxidation (undue loss of iron to the slag), and avoidance of slopping . . . The process conducted under these conditions avoids a deep penetration of the oxygen gas into the molten bath which seriously impairs refractory life at the bottom of the refining vessel."[231]

[132] This last explanation is in actuality a part of the endothermic action in the rest of the bath outside of the localized reaction zone to surface center where the exothermic occurs as this is then described by the Suess patent specification.[232] This I conclude actually contains the much overlooked key to the successful results of the Suess process.

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[229] Compendium XVIII, page 423.

[230] Compendium XVIII, pages 423-424.

[231] Compendium XVIII, pages 424-425.

[232] Compendium XVIII, page 425; Exhibit PX1, col. 4, lines 43-75, col. 5, lines 1-5.

In seeking a gauge by which the term "deep penetration" was taught by Schwarz and Miles, and of believing that the District Court had made a finding in this connection as it related to the Suess application, the Appeals Court suggested that "Even if 'avoidance of deep penetration' could be given a broader meaning than a "practically negligible penetration,' " the file wrapper estoppel would prevent it from being so read and for this reason "the patent must be held invalid." [233]

Since I have already detailedly discussed the file wrapper estoppel question, it is apparent that the Appeals Court could only be guided by the *sua sponte* thinking of the District Court and of the record which it had in that connection. Much of what was stated by the District Court was re-stated and in effect approved by the Court of Appeals. I stated elsewhere that the **[133]** term "avoidance of deep penetration" was never discussed before the Primary Examiner as a "conflicting element," and if the evidence of the Primary Examiner had been before the District Court it is quite likely that the Appeals Court would not have declared that the record was "void" as to the content of the discussion with the Examiner on May 1, 1957. It is obvious then that the real importance of the wording before the Primary Examiner, even as it was noted in the file wrapper history, was not one of similarity to prior art but of the differentiation between the Suess et al. patent and the prior art. As well, instructions for placing the oxygen jet at the surface center of the bath was not a matter of limitation of patent claims, but rather a clarification of wording and the adoption of appropriate words as reflected in "blowing with oxygen, which comprises discharging a stream of oxygen vertically downwardly through the slag layer onto and below the surface of the bath at the central portion thereof, to an extent to avoid material agitation of the bath by the oxygen stream, the contact of the oxygen with the bath

[233] Compendium XVIII, page 427.

resulting in reaction of the oxygen with a portion of the iron and with the oxidizable impurities of the bath in a localized reaction zone . . ." [234]

[134] Except for the fact that the claims throughout this patent proceeding in the United States Patent Office made the distinction in the deep penetration of the prior art and the avoidance of deep penetration in the Suess et al. patent application, as they were required to set forth the differentiation by law, none of the claims particularly pointed out and distinctly claimed "avoidance of deep penetration" as the "subject matter which the applicants regard as [their] invention." And, further, the applicants never claimed "the gist of the invention" to be "avoidance of deep penetration" or "reduction of impact pressure" as the subject matter of their invention.[235]

The Appeals Court also said that "Appellants have insisted throughout this case that they regard the subject matter of the patentees' invention to be 'avoidance of deep penetration.' " Since the matters in this case were handled by lawyers specialized in the field of patent procedure and processing, I would assume that they would be very much acquainted with the requirements contained in § 112 that the claims must contain the subject matter particularly pointed out and distinctly claimed, which the applicant regards as his invention.

[135] The question arises why would the applicants have "insisted through this case that they regard the subject matter of the patentees' invention to be 'avoidance of deep penetration.' " [236] In my inquiry of the record as it may or may not have supported the conclusions and findings con-

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[234] Compendium XVIII, pages 429; (Exhibit PX1, col. 12, lines 12-19).

[235] Compendium XVIII, Page 430.

[236] Compendium XVIII, page 431.

tained in the prior Opinions, it was apparent that the plaintiffs had insisted at McLouth that the big difference between the Suess et al. patent and the prior art was in the avoidance by Suess of deep penetration as against that of the prior art. But nowhere was it claimed to be the subject matter of the patentees' invention; neither was the term "to avoid material agitation of the bath by the oxygen stream" pointed out as the subject matter of the invention. While that term was used, as testified to by the Primary Examiner, there is nothing in the entire patent to indicate that it was used other than in an explanatory fashion. A differentiation from the prior art and as a caution to avoid the faults of the prior art.[237]

[136] The Court of Appeals, as did the McLouth District Court, charged the plaintiffs with attempting to relate the phrase "avoidance of deep penetration" and incorporate it in the term of the claim ". . . to an extent to avoid material agitation of the bath by the oxygen stream * * * and to the phrase '* * * contact of the oxygen with the bath resulting in * * * a localized reaction zone spaced a substantial distance from the refractory lining * * *'."

The Court of Appeals found that neither of these phrases could be interpreted as limiting the penetration of the oxygen stream to a " 'practically negligible' penetration." Since I have discussed this in connection with my inquiry of the District Court Opinion, it is not necessary that I repeat it here.

However, in the consideration and discussion by the Court of Appeals and its interlinking of the term "practically negligible penetration," I believe that the Court of Appeals, like the District Court, was unaware of the significance of the technologically chemical functioning of the impingement of the oxygen jet upon the metal bath surface, with its further technical chemical consequences. Since I have already

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[237] Compendium XVIII, page 431.

elaborated [137] on this phase of the impingement of the oxygen jet and its chemical generation of reactions, I repeat here only that it would seem that by the instructions contained in the specification within its limitations as prescribed, such an impingement causes, first, an indent which lies linearily below the surface of the bath, and that this would satisfy the description of a "practically negligible penetration" of the surface; and second, that the chemical interpenetration between the oxygen atoms and the iron and other atoms in the bath, violated the surface linearity of the molten metal; and that the words in the claim "onto and below taking color from each other placed the position of the jet in relationship to the surface and so this would also satisfy the words of limiting the jet penetration to a " 'practically negligible' penetration to a 'surface layer' penetration." [238]

Here I should explain that the prior Courts had extracted from the affidavits filed with the continuation-in-part application the words " 'practically negligible' penetration". As for the thinking about "avoidance of deep [138] penetration" the Court of Appeals restated what the District Court had said that both Schwarz and Miles places the same limitation on depth of penetration as it related these prior arts to " '* * * a localized reaction zone spaced a substantial distance from the refractory lining.' "

Here again with the Court of Appeals following the thinking of the District Court as it related to the physical application of the deep penetration of the prior art and of the avoidance of the deep penetration of the Suess patent misinterpreted the distinction between the two. The prior art in its reaction zone placed the jet not only on the inside of the bath but also as an elongated oxidizing agent "in the manner of a solid body" placed it all the way from the surface into the bath, and when directed particularly angularly, as was indicated should be done, the jet no longer

[238] Compendium XVIII, at page 432.

became "localized" but rather unlimited, unconfined and uncontrolled as a single phase inducer of chemical action. Whereas, the Suess process placed and controlled it on the surface center of the bath for the purpose of creating a localized reaction zone there in close proximity with the slag. This was reflected by the instruction given in the Suess specification on vertical, central placement of the nozzle, diameter opening of the nozzle, atmospheric pressure of the oxygen jet, distance from the bath and ratio of [139] bath depth to area surface. None of which instructions were contained specifically in combination, particularly, in either Schwarz or Miles. Thus, these facts do not support the statement of the Court of Appeals that ". . . in the instant case we are concerned with a patent *that varies from the prior art only in the alleged degree of penetration of the oxygen stream*" (Emphasis added).

Arguably then, if avoidance of deep penetration was the only element involved in the Suess patent, then why would there have been any need for any other instructions including those just repeated here.[239]

The Court of Appeals decided the fact that the specification nowhere established a standard for determining when agitation becomes material or related the amount of agitation to the depth of penetration and any interpretation one skilled in the art might have placed on "avoidance of material agitation" would not have been the " 'practically negligible' penetration" that the patentees represented to the Patent Office as "avoidance of deep penetration."

[140] It is regrettable that the prior District Court and the Court of Appeals afterwards did not have before them the deposition of the Primary Examiner. For then its understanding of this matter would have been clarified. Thus, if the Court of Appeals had had before it the thinking of the patentees that "material agitation" represented in part

[239] Compendium XVIII, page 434.

only the deep penetration as it provided the stirring, circulating or agitating by the jet in the inside of the bath as it was practiced in the prior art of Schwarz and Miles. Even if the specification of Suess or its claims had contained the words "avoidance of deep penetration," its obvious significance would be as it was found by the Primary Examiner not one of degree of avoidance of penetration but of not injecting the oxygen jet so as to make it function on the inside of the bath. We know, too, that neither Schwarz nor Miles provided measurements of recommended penetration, and that both merely stated that the oxygen agent was to be injected into the bath. However, both Schwarz and Miles made us aware of the fact that it could not be an impingement contact of the oxidizing agent with the surface **[141]** of the bath but one which had to be injected into the bath.[240]

The balance of the Opinion of the Court of Appeals generally dealt with the matter "avoidance of deep penetration" in its various phases of lack of explanatory differentiation from the prior art, lack of definition and limitation, lack of description of this phase as the subject matter of the invention, expanding this phase from the position of the applicants of a " 'practically negligible' penetration" and of the eventual abandonment of that phase of the claimed invention.

The Court of Appeals asserted that the term "deep penetration" and the depth of penetration "can gain meaning only from the limitations placed upon it by the patent and from the knowledge that may be attributed to an ordinary worker skilled in the art." While it is true that the patentees did not specify depth in matter of inches or meters, it must be realized that they could not do so because of the variation in sizes of steelmaking vessels, and because such knowledge would, of necessity, become encompassed in the expertise of the steelmaker. That

[240] Compendium, XVIII, at pages 436-437.

this is so is borne out by **[142]** the Opinion of the District Court that not only could expert steelmakers from McLouth, but also certain experts of the plaintiffs from the instructions given in the Suess specification use the process and make steel. Furthermore, that instructions as contained in the specification could be extrapolated for various size furnaces. Thus, while the depth of penetration is not specified in inches or meters in the Suess specification, it is controlled by the instructions contained in the specification of working within limits, of height of nozzle from bath surface, limits of nozzle opening diameters, limits of ratio of bath depth to bath diameter and vertically or approximately vertically central placement of the nozzle over the bath.[241] Furthermore, these specifications contain the fully detailed, clear instructions and examples which point out the limitations of the invention of blowing an oxygen stream at a pressure between 5 to 25 atmospheres, vertically downwardly through the slag, onto and below the surface of the bath at the central portion thereof, but only to such an extent as to avoid material agitation of the bath by the oxygen stream, **[143]** so that when the contact of oxygen is made with the bath, a chemical reaction results at the place of impingement. Whereupon the oxygen combines with the iron and oxidizable impurities of the bath in what the specification calls the localized reaction zone spaced substantially away from the refractory bottom and walls.

The specification is specific in describing the reactions which result in the exothermic iron-gas evolution which produced a high temperature away from the refractory lining. Here the first activity which eventually produces a circulatory movement in the molten bath as endothermic chemical reactions occurs, and this brings the other portions of the molten metal bath remote from the reaction zone into the reaction zone where they are subjected to the reaction in the localized impingement area for continuing

[241] Compendium XVIII, page 439.

chemical reaction as long as oxygen and oxidizable ellements exist for chemical combinations. Under this proceess the specification assures that the refractory lining will be preserved.

[144] Thus a steelmaker skilled in the art is made aware of what the character of penetration seems in regaird to a particular vessel with which he is working and the potential pitfalls of the different prior arts. This differemtiation does not require definition by a ruler or a gauge, butt rather by all of the instructions of the patent as a whole and by the information which it gives to a person skilledl in the art of steelmaking, as well as an indication of the diffference of the art he is practicing and the prior art, reggarding which he is admonished to avoid of what may be its various faults.[242]

All of this was sufficiently described, particularlly as it was directed to the persons skilled in the art of steel-making by testimony in the record of Dr. Hauttmann and Dr. Trenkler.[243] Other circumstances are related by the Court of Appeals and have already been more or less discussed herein. It is important, however, to note that what the Suess process accomplished besides producing steel of a quality equal to that from the open-hearth, it accomplished the seemingly **[145]** insoluable task of saving large quantities of iron in the steel while at the same time eliminated the sulfur and phosphorus from the iron in a way in which the prior art never taught and was never able to do.[244]

One additional matter to which the Court of Appeals referred to in Footnote 11 (400 F.2nd at page 48) inferred that the Gerlafingen blowing experiments were hampered because it did not have an oxygen plant, and because other

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[242] Compendium XVIII, page 441.

[243] Compendium XVIII, page 441-442.

[244] Compendium XVIII, page 445.

factors made experimentation "cumbersome." The statement was made that Linz had "better conditions." There is no evidence in the record that the Linz experimenters possessed an oxygen plant during their experimentation period from early June, 1949 to the end of November, 1950. Their equipment was also home-made as is evidenced by the fact that in the first test the nozzle melted, and in the second test that the water surround broke and sprayed the metal. There were also indications that the experimenters were making make-shift appliances and improvement during the course of their experimentation. Thus, this character of evidence neither adds nor detracts from inventive discoveries which the Linz experimenters made as against the failure of the Gerlafingen experimenters to make inventive discoveries.

[146] Blonder-Tongue Collateral Estoppel Determination

Before reaching a determination on the issues in this case, because the subject matter relates to scientific knowledge and because the Supreme Court has spoken in this regard, I deem it appropriate to keep in mind what Mr. Justice Matthews said in Eames v. Andrews, 122 U.S. 40, 55-56 (1887):

> "It may be that the inventor did not know what the scientific principle was, or that, knowing it, he omitted, from accident or design, to set it forth. That does not vitiate the patent. He sets forth the process or mode of operation which ends in the result, and the means for working out the process or mode of operation. The principle referred to is only the why and the wherefore. That is not required to be set forth."

In reaching a decision here I am convinced without a doubt that the Suess process for the conversion of molten iron into steel is an extraordinary invention. In fact I concur with the District Court's finding that the Suess process was a "revolutionary invention." Neither can I ignore the fact that the veteran oxygen steel experimenter, Dr. Durrer,

stated that "This work shows a new metallurgy with which we must first of all become acquainted." I am aware of the statements of the many experts who testified that they did not believe that such a process by oxygen application to molten iron instead of fuel was possible, and that they could only believe it when they saw it accomplished.

[147] I do not disregard the statements which was made in the McLouth trial that many of the steelmakers throughout the world came as skeptics and went away believing in the process and adopting it. I am also aware of the fact that McLouth, buying know-how and still not convinced, built duplexing equipment at great expense, and after seeing the process in action as they had learned it from the Suess people, became believers and tore down the duplexing equipment.

Althought the accomplishment of this final achievement was in reality the accomplishment of untold numbers of people through the centuries, particularly commencing with the establishment of the first blast furnace in India, Bessemer's air-blowing vessel, and the discovery of the discovery of the Siemens-Martin, or open-hearth furnace, still a great deal of credit is due to the originator of the idea of applying oxygen to the surface rather than from the bottom, as Schwarz and Miles contemplated it and as the outstanding experimenters Durrer and Hellbruegge, in spite of their own failures contributed advice and encouragement to the Linz people.

[148] The true invention came about whether by accident or by perceptive intelligence, when the Linz experimenters brought about a separation of the chemical process practiced in the prior art of Schwarz and Miles into two component chemical parts by the creation of a localized reaction zone at the surface center of the molten bath. Here the first phase of exothermic action was accomplished by the necessary knowledge required for its creation and control; and the second phase resulted in the endothermic

action within the bath where the consequential high temperature created in the exothermic or localized reaction zone brought about, first, the protection of the refractory linings and a prevention of their breakdown so as not to introduce into the bath the harmful manganese as occurred in the prior art, and second, the capability of permitting the iron oxides and other oxides created in the localized reaction zone with the carbon monoxide created thereafter with dissolved oxygen to become a motivating force and cooling device by which the high temperatures created in the localized reaction zone provide additional movement or augment the circulation which had already been created by the chemistry and high temperature in the localized zone.

[149] This discovery brought about a solution of the two prior problems, first, of providing a fast and less expensive method of producing a controlled steel end-product equal in quality to that produced by the open-hearth method, and second, an economical saving of the refractory linings of the vessel. The law required that the process or mode of operation or means for working out the process or mode of operation be set forth with sufficient clarity so that those persons skilled in the art might use and work it to produce the end results. It did not require that no experimentation was to be done; it required only that persons skilled in the art be able to work it to bring about the promised results. This record shows was accomplished so well that it became very quickly the almost exclusive method, world-wide, of direct refining of pig or blast iron into the sought after steel, speedily and efficiently.

The discovery of creating a localized reaction zone at the surface center of the molten metal bath was recognized by the Patent Office as novel and nonobvious to the prior art, as a feature of the new invention. The Patent Office, in fact, [150] aided the patent applicants to arrive at wording which would define and explain that feature.

The Patent Office was also aware of the Invention's creation of a localized reaction zone at the top center of the bath and of the necessity not only of permitting any stirring within the bath as in prior art, but also of not disturbing the localized reaction zone by any "material agitation" by the jet. It approved the language finally agreed upon to explain these phenomena as such is set forth in the Claims.

The Suess patent explains the prior art and its difficulties, and thereafter recites its objects directed to persons skilled in the art of steelmaking. It then provides a series of detailed instructions. The preliminaries must be physically prepared and performed by the operator prior to the application of the oxygen jet to the metal, which is also physical in nature. Thereafter it describes the scientific take-over which naturally originates as the oxygen combines in chronological fashion with various oxidizable impurities in the iron bath. And while it asserts the belief that certain circulation occurs in the bath, it provides a scientific step by step explanation of the formation of a localized reaction zone where the high temperatures occur and of the methods by which the high temperatures are sufficiently converted in a secondary function of bringing the balance of the oxidizable material within the bath to the localized reaction zone for the continuing activation of the process until, when the oxidation has been completed, the chemical reaction abates, and the oxygen jet becomes impotent. The patent provides the required **[151]** examples in the specification; and at the end of the specification the patent sets forth its claims wherein the applicants particularly point out and distinctly claim the subject matter which the applicants regarded as their invention, while at the same time differentiating the subject mater from the prior art, and cautioning against interference with localized reaction zone.

As I said before, the evidence is undisputed that persons skilled in the art of steelmaking could use and make the

process in smaller size vessels and could extrapolate the instructions for use and performance in varible and larger size vessels. At the same time the subject matter, which the applicants regarded as their invention, was pointed out and distinctly claimed in such a clear fashion that no one skilled in the art of steelmaking could be confused as as to what the subject matter of the new invention was and of its differentiation from the prior art. Thus the patent was in full compliance with the patent statute which requires that a new invention have the three elements of novelty, non-obviousness and utility as prescribed in 35 U.S.C. §§ 102 and 103, and as well fulfill the requirement of § 112.

[152] On infrequent occasions, judges are confronted with patent cases in which not even skilled experts and professors can so clarify the scientific use of circumstances for an invention as to make it sufficiently perceptible for judicial determination on its technical or technological subject matter and the issues or questions which are raised in litigations in that respect. I believe that this is one of those uncommon cases where this has happened.

After the preliminaries are prepared, according to instructions, and oxygen made to impinge upon and make contact with the metal bath, the specification explains what happens thereafter as chemical reactions from *beginning to end* as detailed in col. 4, commencing with line 43-75, continuing in col. 5, lines 1 through 5 and col. 6, commencing with line 62 and ending with line 72. It will be seen that all of this is chemical. Although the specification does not say in any words or provide any reasonable basis for an inference that the oxygen jet produces a physical or mechanical circulation in the metal bath, the District Court took two words out of their chemical context and interpreted the word "goes" (col. 4, line 55) and the word "diffuses" (col. 4, line 56) as being a physical or [153] mechanical activity rather than a result of the chemical

reaction and high temperatures created thereby, the same as is the "flame" (col. 4, line 45) and "fume" (col. 4, line 53), the result of chemical reaction. Thus here was the first misreading of the technical language and the misinterpretation which I believe influenced the District Court to view the invention as being physical or mechanical.

Believing the words of Dr. Durrer that "this work shows a new metallurgy with which we must first of all become acquainted" (257 F.Supp. at page 417), the District Court saw the oxygen steelmaking process at Linz, Austria as "an outstanding invention" and one of "a revolutionary nature". And so being a physical or mechanical invention, the District Court believed that it did what those persons skilled in the art of steelmaking and the experimenters of oxygen to iron had not thought of—and that was changing from a Laval nozzle to a regular nozzle and heightening the nozzle from 10 centimeters above the bath to 15 centermeters above the bath. So that this reduction of impact pressure the District Court concluded avoided the deep [154] penetration of the prior art, and thus was the gist of the invention. Convinced of this interpretation and point of view, the District Court while on occasion mentioning other factors, gave little if any regard to the instructed features of the patent and read into the patent the two differences, only, which had been indicated existed between the prior art and the June 25th experiments at Linz.

Although the finding of the District Court that the circulation in the bath was physically or mechanically produced by the oxygen jet, it was nevertheless in accord with the contention of McLouth and the skillful argument of its counsel. And yet the District Court Opinion makes it evident that the supports for this finding came not from McLouth's expert witnesses, but from the negative conclusions drawn from the testimony of the plaintiffs' expert witnesses, and from the "tangible evidence" adduced *sua*

sponte by the District Court from the Ann Arbor demonstrations, particularly Nos. 7 and 9, as such were eventually proved to be misinterpreted both factually and scientifically.

[155] Upon this fallacious basis and thinking the District Court arrived at the finding that the localized reaction zone was a fiction; and that since avoidance of deep penetration was the gist of the invention and that these words were abandoned and not used in the final claims, file wrapper estoppel applied even though other words had been used which "in so many words" provided no causal connection—in spite of such connection by two of the applicants in their filed affidavits. All of this eventually became the thinking and affirmance of the Court of Appeals.

As I previously said that the patent prescribes certain physical functions for the performance of the steel operator and, thereafter, provides for natural, chemically technological functioning as the process generates oxidation reaction in a localized reaction zone, I said that if there is any invention at all it is by this phenomenon by which it can exist. Yet not only was this phenomenon, the localized reaction zone, not recognized by the District Court because of its misconception that it could exist within the bath as in the prior art, and further, because it did not recognize that the prior art **[156]** injection of the jet in the manner of a solid body" or a device to "agitate and circulate the bath" was not comparable to, or identical with the localized reaction zone at the surface center where its two-phase chemistry initiated, the District Court failed to grasp the true invention as it was recognized by the Patent Office Primary Examiner; and by such non-conception it substituted a physical or mechanical theory that "avoidance of deep peneration is the gist of the invention". Thus it also misconceived what was the subject matter in the claim which the applicants were required to point out and claim as their invention. For this reason I could conclude that the file

wrapper estoppel was based upon a factitious set of circumstances and therefore not applicable. However, I have already ruled in this connection and what I said heretofore merely strengthens my own belief that the true invention was miscomprehended. Yet, this is not dispositive of the complete question before me of whether collateral estoppel in accordance with the guidelines of Blonder-Tongue is applicab'e in these consolidated cases before me.

[157] The law provides than an inventor set forth in the specification "a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same . . ." (35 U.S.C. § 112). However, the specification is sufficient if a mechanic skilled in the art to which the invention pertains can, from the specification, construct and use the invention described. *Woodworth* v. *Wilson*, 4 How. 712, 716 (1846); *Wood* v. *Underhill*, 46 U.S. 1 (1847); *Expanded Metal Company* v. *Bradford*, 214 U.S. 366 (1909). In this connection I considered the matter of McLouth paying $100,000 to Kaiser, one of the plaintiffs, for know-how and as did Jones & Laughlin.

If the specification was explanatory enough for the experts skilled in the art of steelmaking to make and use the process, then why should either McLouth or Jones & Laughlin have paid $100,000 for such know-how?

I conclude, first of all, the process was indeed what Durrer termed it "a new metallurgy" and what the District Court termed it to be "a revolutionary process" and one with which steelmen were unfamiliar and in fact so skeptical that they **[158]** could not believe that oxygen could take the place of fuel as in past steelmaking processes. This made the steelmakers wary so that when it came to expending millions of dollars for the construction of oxygen to iron steelmaking plants concerning which the past history of the

steel industry was completely unknown, the sum of $100,000 paid by each of these was economically a miniscule amount.

The evidence indicates that McLouth (and J & L in the instant consolidated cases) wanted the expertise of Kaiser as a steelmill builder for the construction of the kind of plant which would most conveniently and best accommodate the new process.

Thus, know-how did not present a tangible question, particularly in the face of the fact that the expert steelworkers at McLouth admitted on various occasions that they were able from the instructions of the specification to make and use the process and to extrapolate it according to various sizes of tonnage vessels as required. Thus, also, this does not bear upon the question of whether or not the matter of estoppel is applicable in these consolidated actions.

[159] I have also considered a very serious question of whether the patentees had had a full and fair chance to litigate the validity of their patent in the McLouth trial, whether by reason of fault of their own they were deprived of crucial evidence or witnesses in the first litigation (*Blonder-Tongue* v. *University Foundation, supra,* at page 333). While I have observed that in its Opinion the District Court had been persuaded to some of the contentions by McLouth counsel, it was not persuaded on certain others. I observed that this was true in the same way in consideration of some of the plaintiffs' contentions. But two matters are of concern to me and received my special attention, when the District Court arrived at certain findings as these were presented by plaintiffs' expert witnesses or argued by plaintiffs' counsel. As for instance, the District Court found that "throw-out" from Ann Arbor Demonstration No. 7 was "agitation" of the bath instead of "turbulence" as it was used in the specification, signifying the overall activity both physical and chemical of the process while in the course of oxidation. I noted this difference from the "agitation" as it was used in the specification, as a chemical resultant

[160] and also in its activating or causative sense to augment the bath circulation. I distinguished this from the other and only use in the patent in connection with its physical causative significance as it was used in the claim of the Suess patent.[245] I observed that there was no confusion in the specification of their respective uses; that there was, as in other terms contained in the patent, exclusivity about their positioning in the context where they lent specific significance of what the patentees intended to convey to persons skilled in the art of steelmaking.

And yet I observed that two of the plaintiffs' experts used the term "agitation" on two occasions particularly in the same way as did the District Court. On one occasion, Dr. Chipman was asked in cross-examination (R. 945):

> "Q. Now, when there is penetration of the molten bath by the jet, and there is resultant splash, there is creation of considerable stirring or agitation within the bath as a result, isn't that so Doctor?
>
> A. There is considerable agitation as a result of the action that you describe, and an even stronger agitation as the result of the explosive formation of the CO bubbles."

[161] Here we see Dr. Chipman picking up the words used by his questioner and answering the question in kind. However, on the whole of Dr. Chipman's testimony, I observe that it pretty well confined the use of the word "agitation" in its claim significance.

On another occasion when Dr. Elliott was under direct examination (R. 6273-6276), he discussed the "relatively small" circulation after the lance had been withdrawn. He was afterwards drawn into a discussion of the "hot spot" or the "localized reaction zone" as "they caused

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[245] Compendium XII, page 218.

circulation" in the bath. He referred to this "as a second reaction of importance, that is the reaction between iron oxide, FeO and carbon in the bath to form CO gas and iron." As to the rapidity of these actions he referred to a picture presented by Dr. Chipman of the character of the violence or the reaction of carbon in the bath with iron oxide on the surface. He then said "There is considerable agitation, action when this occurs." However, this incidental use of the word "agitation" as it signified the total action of the bath as the word "turbulence" was used in the specification in its resultant sense was not mistakable, and should not be confusing when read in the light of the specification and the claims of the Suess patent.

[162] Concerning whether or not there was fault on the part of the plaintiffs, I considered the submissively respectful attitude of plaintiffs' counsel in the final argument as he attempted to introduce the various combination features or factors of the Suess patent process, and as he attempted to emphasize the significance of the "localized reaction zone". From all of this I deliberated whether or not counsel's seeming agreement in part with the District Court constituted some fault on the part of the plaintiffs themselves. As for example, as was mentioned in the District Court's Opinion (257 F.Supp. at page 425), counsel for the plaintiffs stated (R.13, 187-13, 188), "'They [the patentees] learned that you have to avoid the deep penetration; * * * in other words, they had to reduce the impact pressure. * * * They arrived at this thought: . . . Maybe we've got to cause this oxygen to impinge on the surface of the bath with a lower impact pressure and avoid stirring the bath by the oxygen stream . . .'" Thereafter plaintiffs' counsel said the gist or the primary difference between the prior art process and the L-D process was that "You avoid deep penetration." He also said not **[163]** too literally that "'The affidavits point out that the crux of the invention was reducing the pres-

sure of the oxygen on the melt so that you did not have this deep penetration.' " However, counsel for the plaintiffs did not leave it at that, when he said, " 'Well, I think, as I pointed out the other day in our main brief, we pointed out a number of other distinctions between Schwarz and Miles.' " I noted elsewhere the numerous, various attempts which counsel made to bring to the attention of the District Court the other instructed factors which made up the localized reaction zone.

In good conscience, I must recognize the fact that even with highly skilled practioners, such as were the counsel on both sides in the McLouth case, over-emphasis is a common fault of counsel as they endeavor zealously to serve their clients. This should not be condemned. However, should counsel in a case be overly agreeable and fail in clarifying factual or legal issues when they arise. It is expected of him that where he believes a judge is in error that he persist in orderly **[164]** fashion to sufficiently attempt a clarification of such an error or misunderstanding or non-understanding, if he can.

Such arguments of counsel on both sides did not misguide the District Court. It was the master of its own thinking when it interpreted the Suess patent and correlated it to the prior art patents of Schwarz and Miles, and even of Potts.

Unlike criminal cases where a defendant must know and be agreeable to what his attorney says before he can be held responsible for the attorney's remarks, the plaintiffs here would be held accountable for what their counsel stated. However, when we look at the efforts which counsel for the plaintiffs made to endeavor to bring to the court's attention the technical factors which constituted the Suess patent process, I could not consider them as misleading. This is particularly so because the specification must be read and translated in the ordinary literal and scientific manner as it was intended by the inventors

and as they addressed the patent to persons skilled in the art of steelmaking. And when so read and translated, it would negate any erroneous statemnts made by counsel. We must take what counsel for the plaintiffs said as a whole, and **[165]** when so taken, it appears doubtful that he caused the District Court to find as a fact that the *only* inventiveness about the Suess process was "avoidance of deep penetration" or that the *only* significance about the new invention was the lessening of impact pressure. Accordingly, I cannot attribute this as a fault to the plaintiffs, also in view of the fact that the District Court took out of context certain words from the specification explaining the chemistry involved and interpreted them to be not chemical but physical in significance as its incipient thinking.

Thus, I am of the opinion that it was not what counsel stated which influenced the District Court to find that "avoidance of deep penetration is the gist of the invention." Rather it used its own interpretation of the specification and its own scientific findings, which it termed "tangible evidence in the record" as well as the other findings in relation to the non-credibility of the plaintiffs' expert witnesses. These contributed to the District Court's determination that avoidance of deep penetration is the gist of the invention and that because these words were not included "in so many words" in the claim, the patent was invalid.

[166] In considering whether the patentees had a full and fair chance to litigate the validity of the patent at McLouth, I firmly believe that the subject matter presented issues "so complex that legal minds without appropriate grounding in science and technology [had] difficulty in reaching decision". *Blonder-Tongue, supra,* at page 331. I believe that with the incipient interpretation by the prior District Court that mechanical action produces the gist of the invention, it failed to recognize the specific instruc-

tions in the specification for bringing about the true invention of localizing the reaction zone at the surface center of the bath as a metal-chemistry discovery, and so found the localized reaction zone to be a fiction. This failure of chemistry interpretation influenced the District Court to hold *sua sponte* that the doctrine of file wrapper estoppel prevented the patentees from availing themselves of its assumed finding that "avoidance of deep penetration was the gist of the invention", and further that the words so used to clarify the significance of the localized reaction zone and its differentiation from prior art, as suggested by the Patent Office Primary Examiner, presented a [167] serious defect of equitable dimensions. This was so particularly because *Blonder-Tongue* subsequently could work a collateral estoppel against the plaintiffs from any further actions otherwise previously permitted by *Triplett, supra.* Certainly, in any event, in this sense the plaintiffs were, regrettably, deprived without fault of their own, of the right or privilege of presenting crucial evidence in the prior case.

Thus such a prior proceeding was seriously defective and its review by the Appeals Court without correction of the serious defect by the District Court struck down a patent in the United States which was recognized as valid throughout the rest of the world. In this connection it is important to note the reference by the Supreme Court in *Blonder-Tongue, supra,* at page 331, footnote 21, where it quoted from *Sinclair & Carroll Co.* v. *Interchemical Corp.*, 325 U.S. 327, 330 (1945): "It is just as important that a good patent be ultimately upheld as that a bad one be definitively stricken."

[168] I am firmly convinced that the prior McLouth case was one of those uncommon and infrequent cases to which the general principle of collateral estoppel should not apply. I am of the belief that it would be an injustice

to apply the doctrine of collateral estoppel here, in view of the fact that the Constitution and the statute, as well as judicial law, intend to encourage inventiveness and protect it, when genuine, against the many anxious competitors who stand ready to appropriate such new discoveries without having earned it or given consideration for its use and benefits. I deem it a matter of justice and equity based upon facts and law that collateral estoppel in accordance with the guidelines of *Blonder-Tongue, supra,* is not applicable in these consolidated cases before me.

Accordingly, the plea of estoppel raised by the defendant, Jones & Laughlin, in these consolidated actions will be denied.

[169] This Opinion Compendium and Opinion Summary constitutes Findings of Fact and Conclusions of Law in accordance with the requirements of Federal Rule of Civil Procedure 52(a). The parties may submit further proposed Findings of Fact and Conclusions of Law consistent with this Opinion and an appropriate Order shall be submitted.

OPINION COMPENDIUM—COLLATERAL ESTOPPEL

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I. Introduction

[1] Two consolidated patent actions, Civil Action 61-551 and Civil Action 62-272, are here before me for licensing, validity and infringement determinations. These actions are based upon the Suess et al. Patent No. 2,800,631, issued for a process for refining of molten metal with high purity oxygen.

In the first action the plaintiff, Kaiser Industries Corporation (Kaiser) charges the defendant, Jones & Laughlin Steel Corporation (J&L), with a breach of contract and seeks to recover royalties allegedly due under a license agreement (PX-7A) covering two steelmaking converters at the defendant's steel mill in Aliquippa, Pennsylvania. The second suit is brought by the plaintiffs, Kaiser (a Nevada corporation), Vereinigte Oesterreichische Eisen-Und Stahlwerke Aktiengesellschaft (VOEST) and Brassert Oxygen Technik Ag., (BOT) (an Austrian corporation) against the defendant J & L (a Pennsylvania corporation) and alleges infringement of the Suess et al. patent by reason of the unlicensed operation of two converters in its Cleveland mill. Both actions were originally filed in the United States District Court for the Northern District of Ohio, Eastern Division and transferred to this District pursuant to 28 U.S.C. 1404(a) by Orders of the Honorable James C. Connell, dated September 14, 1961 and April 9, 1962, respectively. These cases were consolidated here. The defendant J & L not only raised a series of defenses to the complaints, but also claimed damages for antitrust violations by the plaintiffs.

The determination of the issues raised in the original **[2]** pleadings in these two consolidated patent actions must, however, be held in abeyance until the issues raised later by the amended pleadings of the parties and the threshold question of estoppel by virtue of the authority contained in *Blonger-Tongue Laboratories, Inc.* v. *University of Illinois Foundation et al.*, 402 U.S. 313 (1971) are fully inquired into and determined.

These later issues involve prior proceedings, with virtually identical subject-matter to these J & L cases, which had been brought by the plaintiffs on July 19, 1957 in the Eastern District of Michigan against an alleged patent infringer, McLouth Steel Corporation. In *Kaiser* v. *McLouth Steel Corp.*, 257 F. Supp. 372 (1966), the District Court decided against the plaintiffs. This decision was affirmed, *Kaiser* v. *McLouth Steel Corp.*, 400 F. 2d 36, C.A. 6, 1968. The Supreme Court denied certiorari, *Kaiser Industries Corp. et al.* v. *McLouth Steel Corp.*, 393 U.S. 1119 (1969).

Prior to *Blonder-Tongue* the applicable law was that set forth in *Triplett* v. *Lowell*, 297 U.S. 638 (1936), to the effect that the prior adjudication of invalidity of claims asserted in an earlier action does not preclude successive litigations concerning the same issues against different defendants, and courts whose jurisdiction is invoked by subsequent suits for infringement of the patent must separately determine the validity of each claim and are not bound by the prior ruling of the other court.

Blonder-Tongue Essentials

On May 3, 1971, the Supreme Court, for the most part abrogated this rule of law and, only for reasons of justice **[3]** and equity, made limited bases for the admission of justiciable actions to a subsequent court by a previously unsuccessful patentee plaintiff. The holdings in *Blonder-Tongue* were intended to eliminate duplicitous litigation where a patentee could harass different defendants in other jurisdictions. Such practices were condemned as being not only unfair, but as being unsound judicially and economically. In this connection Mr. Justice White stated:

> "Permitting repeated litigation of the same issue as long as the supply of unrelated defendants holds out reflects either the aura of the gaming table or 'a lack of discipline and of disinterestedness on the part of

> the lower courts, hardly a worthy or wise basis for fashioning rules of procedure.' *Kerotest Mfg. Co.* v. *C-O Two Co.*, 342 U.S. 180, 185 (1952)." (402 U.S. at page 329.)

In a word, after a review of the evils and disadvantages existing under the patent procedure law of *Triplett*, the Court in *Blonder-Tongue* declared that ruling to be no longer procedurally appropriate. However, the Supreme Court continued that pro forma stating:

> ". . . we do not suggest, without legislative guidance, that a plea of estoppel by an infringement or royalty suit defendant must automatically be accepted once the defendant in support of his plea identifies the issues in suit as the identical question finally decided against the patentee or one of his privies in previous litigation." (402 U.S. at pages 332-333.)

Rather, the Supreme Court prescribed a series of rules by which it anticipated a justiciable patentee claimant would not be barred from proceeding in a subsequent action on the same subject matter. That these rules contemplated extraordinary and rare circumstances seemed to be contained in what was an [4] obvious safeguard against any injustice which might accrue in a normal collateral estoppel defense. Such safeguards included the right of a patentee plaintiff to demonstrate if he can, that he did not have "a fair opportunity procedurally, substantively and evidentially to pursue his claim the first time" (402 U.S. at page 333). In this connection the Supreme Court asserted that

> "This element in the estoppel decision will comprehend, we believe, the important concerns about the complexity of patent litigation and the posited hazard that the prior proceedings were seriously defective." (402 U.S. at page 333.)

In the case where the issue is non-obviousness,

> ". . . appropriate inquiries would be whether the first validity determination purported to employ the standards announced in *Graham* v. *John Deere Co., supra;* whether the opinions filed by the District Court and the reviewing court, if any, indicate that the prior case was one of those relatively rare instances where the courts wholly failed to grasp the technical subject matter and issues in suit; and whether without fault of his own the patentee was deprived of crucial evidence or witnesses in the first litigation."

In discussing the guidance rules in subsequent litigation, the Court said:

> "We are also aware that some courts have frankly stated that patent litigation can present issues so complex that legal minds, without appropriate grounding in science and technology, may have difficulty in reaching decision." (402 U.S. at page 331.)

Quite logically the Court followed this with the statement that even in cases so difficult "as to provoke a frank admission of judicial uncertainty, one might ask what reason there is to expect that a second district judge or court of appeals would be [5] able to decide the issue more accurately." (402 U.S. at pages 331-332.)

Nevertheless, after analyzing the pros and cons of the patent litigation situation of the past, the Court concluded:

> "But as so often is the case, no one set of facts, no one collection of words or phrases, will provide an automatic formula for proper rulings on estoppel pleas. In the end, decision will necessarily rest on the trial courts' sense of justice and equity. . . .
>
> This is especially true if the court in the second litigation must decide in a principled way whether or not it is just and equitable to allow the plea of estoppel in the case before it." (402 U.S. at pages 333-334.)

Accordingly, with the pronouncement of *Blonder-Tongue* on May 3, 1971, patent trial judges became bound by the

new procedure laid down in that case with the exceptions noted. As of that date, I had already expended the principal time necessary for actual trial work in hearing the evidence of both the plaintiffs and the defendant in these consolidated actions and had already become involved in post-trial matters following the actual hearing of the evidence.

In the first of the two actions before me, the main issue concerned an alleged breach of contract of a patent on the method of converting molten blast furnace iron into steel by the application of high purity oxygen to the molten iron surface. The second of these actions was brought by the plaintiff on the charge of alleged infringement of that patent. Extensive discovery procedure had been availed first by the defendant and afterwards by the plaintiffs over a period of several years, much of which was delayed by reason of the fact that other discovery **[6]** was proceeding in the parallel *McLouth* case in the Eastern District of Michigan. That case was first made ready for trial and eventually did come to trial before the instant actions here. Nevertheless, the parties agreed to sit in and stipulate on all portions of the evidence presented in the Eastern District of Michigan which might be admitted into evidence or otherwise made a part of the record of these cases without actually again calling the same witnesses. I considered the cooperation of counsel in that respect highly commendable.

I had been informed by counsel for the parties that the actual trial of the Eastern District case took approximately fifteen months. The trial proceeded before me for approximately 48 days spread over a period of several months.

It was during the time while we were here engaged in post-trial processes that the District Court for the Eastern District of Michigan handed down its decision and filed an Opinion declaring the patent in question in-

valid. Shortly afterwards, the plaintiffs petitioned for leave to present additional evidence in these consolidated cases such as would clarify the alleged errors or insufficiencies of the prior District Court holdings. Later, the Court of Appeals for the Sixth Circuit affirmed *Kaiser Industries et al.* v. *McLouth Steel Corporation, supra;* and the United States Supreme Court denied certiorari.

The principal disagreement that the plaintiffs here have against the prior decision was that the *McLouth* District Court, *sua sponte,* made a determination that the plaintiffs had abandoned the critical concept of avoidance of deep penetration in their claim before the allowance of the patent and accordingly [7] the principle of file wrapper estoppel applied.[1] The plaintiffs complained that the sua sponte decision was reached without suggestion by the defendant, and without giving the plaintiffs an opportunity to be heard.

The principal evidence presented before me on that matter at a supplementary hearing related to what occurred in the Patent Office at the time the patent application was being negotiated.[2]

It comprised the testimony of the Primary Examiner who allowed the patent and the attorney for the applicants.

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[1] "It is a rule of patent construction that a claim in a patent must be read and interpreted with reference to claims that have been cancelled or rejected and the claims allowed can not by construction be read to cover what has thus been eliminated from the patent." *Schriber-Schroth Co.* v. *Cleveland Trust Co.*, 311 U.S. 211, 220-221 (1940); see also *Trio Processing Corporation* v. *L. Goldstein's Sons, Inc.*, 461 F. 2d 66, 75 (3d Cir. 1972), *cert. denied* 49 U.S. 997 (1972).

[2] The hearing on the issue of file wrapper estoppel was held on April 29, 1970, and constituted the testimony of Byron Gardner, Esq., who was attorney for the patent applicants, and the deposition of Claude A. LeRoy, primary examiner, which deposition will hereinafter be referred to as PX-1002, and all references to the first post trial hearing transcript will be marked "FWE". (File wrapper estoppel)

Primarily the additional evidence presented before me, at the first post trial hearing, dealt with the treatment of the claims in the Patent Office and in various conferences which transpired, because the claims had been rejected. Eventually there was agreement upon acceptable terminology in the claims. The patent was thereafter allowed on June 27, 1957 and issued on July 23, 1957. Following this additional presentation at the first post trial hearing, briefs were filed and arguments heard.

While I was in the post-trial stages of procuring, examining and researching suggested findings of fact, the briefs, and the record, and further researching of such law as the briefs contained, the Supreme Court on May 3, 1971 handed down its [8] pronouncement in *Blonder-Tongue, supra,* which provided for a fundamental departure of procedure from *Triplett, supra.* Following that, the defendant was granted leave to amend its answer to include a defense of collateral estoppel as provided for by *Blonder-Tongue;* and in short order the plaintiffs filed their reply.

At the second supplemental hearing,[3] the plaintiffs argued that *Blonder-Tongue* made the evidence presented at the first supplemental hearing on the file wrapper estoppel even more crucial. Secondly, the plaintiffs argued that the *McLouth* District Court had, by the many and various misstatements contained in the Opinion, shown a fundamental misunderstanding and misapprehension of the technical aspects of the patent specification and claims, and had therefore misconstrued and misapplied the scientific evidence produced before it by the experts in the case. In support of this contention, the plaintiffs produced an expert witness here who testified that he had made certain statements at *McLouth* but that the District Court had misconceived such scientific evidence, as was apparent from

[3] The hearing on the issue of collateral estoppel was held on September 7, 8, 9, 1971, and all references to the hearing transcript will be marked "CE" (collateral estoppel).

the conclusions contained in the Opinion. Additionally, at the second hearing patent experts testified on the issue of file wrapper estoppel.

Following these hearings several arguments were presented before me by counsel for the parties who were granted leave for [9] filing such supplemental documents as they desired and considered helpful.

Thus it was, that while I had been assigned two consolidated actions in which the issues were breach of contract, patent validity and infringement, antitrust violations and possible damages, these issues were for the time being superseded as a matter of law by this intermediate but more fundamental issue.

Before, however, I have any right to even commence considering the fundamental issues thus presented, it is incumbent upon me to not only understand what that authority is but its limitations as well. While the Supreme Court presented representative examples and illustrative guides, it as well conveyed its understanding that it would be humanly impossible to cover the whole gamut of potential problems which might arise and confront a district court. As it said,

> "But as so often is the case, no one set of facts, no one collection of words or phrases, will provide an automatic formula for proper rulings on estoppel pleas." (402 U.S. at pages 333-334.)

And so, a subsequent trial judge is put on notice that he may not only meet up with unpredictable circumstances, but that he must also be prepared to judicially administer them. However, until judicial authority has finally defined the guide rules and mandates laid down in *Blonder-Tongue*, a subsequent judge in any such patent cases must be prepared to make appropriate determinations as are required under the circumstances of the case over which he presides.

Although a considerable number of legal questions are here involved, there are also even more highly technical questions [10] involved. I say this because noteworthy University of Michigan experts were in considerable disagreement with equally eminent authorities from the Massachusetts Institute of Technology.

From my meticulous examination of the Opinions filed by both the *McLouth* District Court and the Court of Appeals in conjunction with an even more scrupulous examination of the specification and inquiry into the testimony of the expert witnesses, I am amazed that a trial judge, at the end of it all, would not become truly perplexed. This in no way derrogates from the high competence and extreme effort earnestly manifested by the prior participating judges and particularly that demonstrated by the untiring adherence of the District Court to an arduous assignment.

Chief Judge Henry J. Friendly of the Court of Appeals for the Second Circuit in his book "Federal Jurisdiction: A General View" (1973) in recommending a specially trained and scientific court for the administration of patent matters, presents an apt discussion in this regard. He said (at page 156-157):

> ". . . the courts must also deal today with a great number of patents in the higher reaches of electronics, chemistry, biochemistry, pharmacology, optics, harmonics and nuclear physics, which are quite beyond the ability of the usual judge to understand without the expenditure of an inordinate amount of educational effort by counsel and *of attempted self-education by the judge, and in many instances, even with it.* The judges who hear the case in a suit for infringement on appeal are no better off except for the benefit they can derive from the district court's opinion. Indeed, save in this respect, they are rather worse off since the limited time available for argument prevents their getting as much assistance from counsel as did the district judge and, once the argument is over, it is cumbersome to

> have further recourse to counsel for help on technical matters that may assume new importance as a result of study." (Emphasis added)

Mr. Justice White recognized this in *Blonder-Tongue,* in the [11] following words:

> "We are also aware that some courts have frankly stated that patent litigation can present issues so complex that legal minds, without appropriate grounding in science and technology, may have difficulty in reaching decision." (402 U.S. at page 331.)

The Court recognized that this same dilemma might just as easily face the subsequent trial judge, when it said:

> "But assuming a patent case so difficult as to provoke a frank admission of judicial uncertainty, one might ask what reason there is to expect that a second district judge or court of appeals would be able to decide the issue more accurately." (402 U.S. at pages 331-332)

It is no great secret that the background education of those preparing for the legal profession includes very limited scientific study. This fact is constantly proved by the background information which the many applications for law clerk service divulge. But even with some scientific background education, in particular chemistry, knowledge has changed and expanded so radically in the past few decades that any judge who might have had any basic training in that science would have to become re-educated. So, too, the advent of using high purity oxygen as a substitute for the open-hearth furnace in the purification of iron has not only improved the steel industry but has presented it with a new kind of metallurgy with which even the steelmakers of the late 1940's had to become acquainted,[4] as we shall see. That the *McLouth* District Court performed not only a gigantic task but a highly abstruse one is demonstrated [12] by the record itself.

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[4] DX-110-E.

That the *McLouth* Courts were required not only to preside over, inquire into, and make determinations on chemical and metallurgical phenomena which had intrigued and baffled the experts, required that the Judges assume a course of study for themselves, presumably with the participants in the case as their teachers.

In this sense, I was in no better position than were the Judges in *McLouth*, except that by reason of the later issues joined, I was made aware of my inadequacies in these sciences. Thus, I realized that the prior Judges were compelled to make determinations on the basis of credibility of witnesses in scientific disputes and that the Court relied almost totally on the testimony of the experts often in derogation of accepted technical, scientific principles and axioms.

Accordingly, I re-examined these scientific assertions when the experts' conclusions clashed with what my research revealed to be scientific principles and attempted to extract scientific facts from the published authorities on the subject. Where I did this, I endeavored to cite such authorities. I earnestly deliberated on whether or not consideration and reliance upon such scientific authorities might be considered erroneous as substituted testimony, but finally determined that justice required this of me under the circumstances of the case.

I was encouraged in this course, by what Mr. Justice Swayne stated in *Brown et al* v. *Piper*, 91 U.S. 37, 42 (1875):

> "Of private and special facts, in trials in equity and at law, the court or jury, as the case may be, is bound carefully to exclude the influence of all [13] previous knowledge. But there are many things of which judicial cognizance may be taken. 'To require proof of every fact, as that Calais is beyond the jurisdiction of the court, would be utterly and absolutely absurd.' Gresley's Ev. in Eq. 294. Facts of universal notoriety need not be proved. See Taylor's Ev. § 4, note 2. Among

> the things of which judicial notice is taken are the law of nations; the general customs and usages of merchants; the notary's seal; things which must happen according to the laws of nature; the coincidences of the days of the week with those of the month; the meaning of words in the vernacular language; the customary abbreviations of Christian names; the accession of the Chief Magistrate to office, and his leaving it. In this country, such notice is taken of the appointment of members of the cabinet, the election and resignations of senators, and of the appointment of marshals and sheriffs, but not of their deputies. The courts of the United States take judicial notice of the ports and waters of the United States where the tide ebbs and flows, of the boundaries of the several States and judicial districts, and of the laws and jurisprudence of the several States in which they exercise jurisdiction. Courts will take notice of whatever is generally known within the limits of their jurisdiction; and, if the judge's memory is at fault, he may refresh it by resorting to any means for that purpose which he may deem safe and proper. This extends to such matters of science as are involved in the cases brought before him. See 1 Greenleaf's Ev. 11; Gresley's Ev., supra; and Taylor's Ev. § 4 and post."

Our Supreme Court constantly refers to published authorities on the many subjects which come before it for determination. So, too, the *McLouth* Judges had a perfect right to rely upon published authorities in aiding them to ascertain the scientific truths particularly where such matters were disputed by the experts. The *McLouth* Opinion does recite published authorities as these were admitted as exhibits in evidence; as for instance, MPX-104,[5] **[14]** a news letter which relates to the new use of oxygen (257 F.Supp. at page 380); and MPX-98-D, a steel magazine

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[5] All *McLouth* exhibit references shall be preceded by "M", as "MPX" or "MDX." This particular exhibit appeared only in the *McLouth* proceedings and also appears in the Plaintiffs' appendices to their Petition for Writ of Certiorari at page 265a. See PX-L-3.

article reprint, which reveals that "sixty-four companies in twenty-three countries have installed the new oxygen steelmaking processes, or are now doing so." (257 F.Supp. at page 386, footnote 2.) Yet the District Court reflected some reliance upon published authority, because it chided Dr. Chipman and Dr. Shapiro for their evidence on "An 'explosive bubble' mechanism" because it "was admittedly not contained in any literature prior to the time of trial." It, therefore, refused to credit this scientific demonstration presented in evidence [6] as proof because, although the "explosive bubble" mechanism showed chemically induced circulation downwardly, such "would not have been a fact known to persons skilled in the art in 1950, since at that time there was no general knowledge among steelmakers of reaction induced circulation." (257 F.Supp. at page 438) Although this example may point some indication on value of published authority, there were bound to be likely instances where published authority could indeed be critical.[7]

As of the time when I presided over the trial of these actions, I was not aware of most of the scientific facts as they [15] came to me subsequently and slowly from references to scientific books during the period of my inquiry into the *McLouth* Opinions and records. Thus, hindsight proved to be a teacher for me which was unavailable to the *McLouth* Judges.

While I am in duty bound to inquire into the functioning of the prior *McLouth* Courts and to, in effect, delve into their very thought-processes, I am not a review court and nothing that I say or do here can in anywise affect the

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[6] Actually the plaintiffs presented a series of explosive visible demonstrations activated by means of squibs, acetylene in glass tanks filled with water.

[7] This reference is to where I discuss 3000-8000 to 1, Opinion Compendium XI, page 213 and Up and Down At The Same Time, Opinion Compendium XIV, page 271.

determinations of the *McLouth* proceeding. The judgments rendered in that case lie undisturbed. My task is to make an adjudication whether or not the judgments rendered in the *McLouth* proceeding constitute a collateral estoppel against the plaintiffs here.

Starting with such preliminary explanations as I have here presented, it is now appropriate that I present as briefly and as intelligibly as possible something of the subject matter, its background and the questions involved.

Iron and Steelmaking

The subject matter with which this litigation is concerned is a technique employed in "the conversion or purification of iron into steel". Three essential elements are critical to the process of steelmaking—iron, carbon and oxygen. We are told that early man obtained iron from meteorites, but since it was a hard mass and malleable, that is capable of being extended or shaped by beating, he learned to make considerable use of it. It is believed that as time went on man slowly learned how to make these hard masses by burning certain "soil" in wood fires. [16] The "soil," of course was iron ore. Later man began to depend upon this substance for conversion into articles of ornament and utility. He learned too that hammering it gave more durability; at least as good as flintstone, or copper with which he had become acquainted even earlier.

The first furnace for reducing iron ore to mass formation is said to have originated in India about 2000 B.C. Its use was subsequently widespread in Europe and even in this country during its early years, and particularly in Pennsylvania and Ohio where the forests provided an abundance of carbon fuel in the form of charcoal, nearby to easily available iron ore, and a constant supply of 20% oxygen in the form of air. However, man was not satisfied with the crude or pig iron that these methods brought him and sought to improve them.

The first device of importance was conceived and developed by Sir Henry Bessemer in the mid 1850's, and presented the first revolutionary idea in a pneumatic converter for the further purification of pig iron. The converter consisted of a bowl-like vessel which was tiltable on trunions and had an opening at the top. A number of tube-like tuyeres were built into the bottom. Through these tuyeres high pressured air was blown into and through the molten iron. The forced collision of the air with the oxidizable materials in the molten iron produced a speedy oxidation between the oxygen in the air and the impurities in the iron, which could be observed from the fiery blast from the mouth of the vessel. The Bessemer process was both speedy and efficient, so far as it freed the iron of silicon and manganese [17] and carbon, but it did not eliminate sulphur or phosphorus and it retained unwanted nitrogen from the air in the finished steel.

The Thomas converter which was used mainly in Europe was the result of the work of two Englishmen, Thomas and Gilchrist, in 1876. They discovered that if the converter is lined with certain basic materials and charged with burnt lime in the pig iron, the slag which forms absorbs the phosphorus oxides produced by the blast furnace. Although the Thomas converter, or as it is sometimes called the acid Bessemer converter, is more efficient, particularly in Europe where the iron ore contains a great deal of sulphur and phosphorus, the steel which it produces also retains an undesirable high nitrogen content.

Another vessel which was developed for refining iron is the electric furnace or converter. The difficulty with this process is that it is an expensive one requiring a great deal of electric power to operate.

Of the very many systems which have been developed over the past decades the Siemens-Martin or open hearth process has been the most popular. It was discovered in the 1870's or 1880's, and by 1954 it accounted for approxi-

mately 85% of the steel produced in the United States. The open hearth process requires fuel oil or natural gas to provide the necessary heat required for oxidizing the impurities contained in the molten metal bath. The steel produced in the open hearth is superior to that of the Bessemer or Thomas methods, and is far more economical than the electric furnace, but it is a comparatively slow process and involves a substantial outlay of capital for its construction [18] and operating costs. Originally the open hearth method took approximately eleven hours to provide the finished steel which was required.

Subsequently certain operators used duplexing processes by which the blast iron was put through the Bessemer furnace and thereafter poured into the open hearth. By duplexing, the time required was cut almost in half. Still later, additional improvements were made which reduced the round-trip time of loading, boiling and emptying the contents of the open-hearth furnace to a four or four and a half hour period, with the use of pure oxygen.

Role of Oxygen Recognized

By the start of the 20th century steelmakers were aware of the harmful effects which atmospheric nitrogen did to the finished steel product, and that it was the oxygen in air which by its combining power with certain elements produced the great heat required in the refining of iron into steel. In 1928 the Linde-Fraenkl process for producing economically large quantities of oxygen by compressing air and causing the oxygen and nitrogen to separate was developed and made possible for experimentation of iron conversion with the use of oxygen enriched air.

Dr. C. V. Schwarz, a German working at the Technical Institute in Austria during the 1930's, made application for a patent on the theory of blowing oxygen or enriched oxygen air onto the surface of and into the interior of

the bath. After this he was issued a patent in 1943. (DX-5-A).

Dr. Robert Durrer had, in 1929, been a professor at [19] Technische Hochschule at Berlin, in which laboratory he had performed refining experiments with oxygen and later he had co-experimented with Dr. Schwarz. In fact Dr. Durrer claimed that the Schwarz patent contained and covered his ideas. In any event, this was the first idea that had come forth for applying high purity oxygen or oxygen enriched air to the surface of the bath. However, Dr. Schwarz in his patent, after asserting that surface contact was not sufficient to produce the rapid reaction which was the object of the invention advocated that the oxygen or oxygen enriched air be brought into as intimate contact with the bath as possible. The process could also be run with oxygen enriched air, carbon enriched air, or pulverulent solids introduced into the liquid bath by means of liquid gases. These were to be applied "with such a high kinetic energy that it was capable of penetrating in the manner of a solid body deep into the interior of the bath by the use of extremely high velocities lying preferably above the speed of sound." (DX-5-A, Page 2, lines 6-9.)

So, Schwarz said that the injected jet must act like a solid device, and he asserted that the oxygen forced into the molten metal would come in contact with all of the elements throughout the bath, and thus the impurities would be oxidized. Schwarz presented few, if any, instructions on how to accomplish the process. Although Schwarz had made application for a patent on his theory in Germany in 1939, he was not issued a patent until 1943. And although he was associated with institutions concerned with steelmaking there is no evidence in the record that the process had been put to commercial use. If the invention which [20] Schwarz claimed he had perfected had been operable, it surely would have been employed during World

War II when steel was in high demand for the production of equipment and materiel. The absence of such evidence lends credibility to Dr. Durrer who testified at the *McLouth* trial that the Schwarz patent failed to yield any practical results. (PX-510, p. 5085.)

In 1946 John Miles and Partners (London) Limited applied for a Belgian patent which was granted on November 30, 1946. The Miles patent was little different in processing from that of Schwarz, but it contained considerable detail. Miles advocated the use of a liquid jet composed of from about 70 to 98 percent oxygen, that is blown deeply into the bath at an angle between 30 and 75 degrees. Miles also advocated utilizing more than one jet to penetrate deeply into the bath so as to stir the contents. He also taught the introduction of heat producing substances so as to raise the bath temperature. As in the case of Schwarz, there is no evidence that the Miles process was adopted by the steel industry in Europe or anywhere else. Also like the Schwarz situation, Dr. Durrer testified that the Miles patent did not yield practical results (PX-510, p. 5085).

The record indicates that in the late 1940's Dr. Durrer was still unconvinced that there was a practical method by which oxygen enriched air or pure oxygen could be utilized in refining iron. Because of this, Dr. Durrer, together with Dr. Hellbruegge began a series of experiments in 1948 at Gerlafingen, Switzerland and continued this work through 1949. These experimentations dealt with the Schwarz, Miles and Durrer theories. Some of the [21] products which were produced were utilizable for limited purposes. The expense involved, however, was prohibitive because the refractories as well as the oxygen nozzle were destroyed. The poor quality of steel being produced prevented the adoption of this system of oxygen application as taught by Schwarz and Miles and as experimented upon by Drs. Durrer and Hellbruegge.

At about the time that Drs. Durrer and Hellbruegge were experimenting at Gerlafingen, the Austrian Government decided to reconstruct its steel industries which had been demolished by bombardments of the Allies in World War II. There were four men in the employ of the Austrian Government who had familiarity with steel production. They were Dr. Theodor E. Suess, Dr. Herbert Trenkler, Dr. Hubert Hauttmann and Dr. Rudolf Rinesch. Both Drs. Suess and Trenkler were familiar with the experimentation which was being carried on by Drs. Durrer and Hellbruegge, and it was arranged for Dr. Trenkler to visit Gerlafingen to observe the experiments being conducted. The results of such experimental work proved to be unsatisfactory because of the high phosphorus and high oxygen content in the steel and because of the necessity of an afterblow in order to remove the phosphorus, and furthermore, difficulties were being encountered with the linings of the vessel and the burning of the nozzles. Dr. Durrer, however, informed the Austrians of his faith in the idea of pure oxygen application for the conversion of iron into steel, and encouraged them to continue the experimentation at Linz, Austria. Following his advice, the Austrians determined to experiment further with the Schwarz and Miles ideas.

They thereupon set up a two-ton vessel at Linz, Austria **[22]** (PX-424, p. 2225) and improvised a nozzle surrounded by water for cooling effect, inserting it directly down to the bath. The first test amounted to no test at all because the closeness of the nozzle to the hot metal melted and clogged it. (PX-424, p. 2228; PX-508, p. 11,933.) During the second test, however, the casing containing the water broke and sprayed water onto the surface of the metal. (PX-424, pp. 2228-2231.)

The experimenters noticed that at the end of the second test they produced a fairly good grade of metal. After inquiry into this success, they decided upon a two pronged

course of experimentation; first they would follow the teachings of Schwarz, Miles and Durrer and Hellbruegge and, at another time, follow their own conclusions of what may have caused the better product in Test 2. Commencing on June 17, 1949, the series of tests according to the prior art were performed and produced unsatisfactory results (PX-424 pp. 2249-2250). The metal was inadequate and the refractories were quickly destroyed. After relining the vessel they commenced a series of tests with their own method on June 25th and perceived better results in the metal and refractory wear. (PX-424 pp. 2249-2250; PX-508 pp. 11,899-11,904.) From there on a long series of experimentation consisting of 250 tests were carried on until November 1950. This involved all kinds of variables and charging vessels up to 30 tons.

From these tests they became convinced that they had a practical process for high purity oxygen conversion of iron into [23] high grade steel. On January 31, 1950, Dr. Suess, believing that he had sufficient knowledge to file an application for a patent, did so in Austria. Dr. Suess based the application upon his conception that a controlled ratio of both depth to surface area favored a circulation within the bath. However, this was only a part of it as became apparent with the later filings. The Austrians, however, continued their experimentation until November of that year.

On January 16, 1951 (PX-2B) Suess filed an application in the United States Patent Office and based it upon theories and instructions which remained practically unchanged until the time when the patent was finally issued. However, the Patent Office was not convinced that this patent with a varied series of claims was not anticipated by Chiswik, Brassert, Cuscoleca and Miles, (all of which were later disregarded.) Because of the dissension among the inventors and their employers in Austria, litigation hindered the progress, particularly in the United States. However, after the litigation was settled in 1955, the four

applicants filed a continuation-in-part application and two affidavits defining the invention and differentiating it from the prior art, particularly that of Miles.

The matter was referred by the Examiner to the Primary Examiner for negotiation of the wording. The earlier claims stated that the method avoided deep penetration of the bath by the oxygen jet. Inasmuch as the prior art emphasized the **[24]** necessity for the jet of whatever composition to be injected deeply within the bath and thus cause it to physically stir the molten metal, the concept of deep penetration had become universally understood by steelmen (PX-1002).

The Primary Examiner objected to the language "avoid deep penetration" (PX-1002 p. 7) for two reasons: (1) that the Patent Office practice attempted to avoid the use of negative limitations (PX-1002 p. 7); and (2) that the prior art theory had become too well known by steelmen and that there was no need for using these differentiating words (PX-1002, pp. 8-9). The Primary Examiner believed that the wording of the claims should express the subject matter of a localization of the oxidizing factor at the central surface area (PX-1002, pp. 8, 28). Thus he approved the wording that the discharge of oxygen under specific limitations of pressure, height, nozzle diameter and the like, should be made to such an extent as not to interfere with the localization of the oxidation process at the central surface of the bath and thus not materially agitate the bath. With such change of wording in the claims as they constituted the first and second claims, the patent was granted.

Immediately upon the applicants' perfecting the method, it became highly successful and desirable throughout the world (257 F. Supp. at page 398). In the United States alone, sixteen mills were built almost immediately (257 F. Supp. at page 380). Since 1955 or 1956 very few new open-hearth furnaces were constructed. (257 F. Supp. at

page 380). The reasons given were **[25]** that first, on the basis of economy the original capital outlay for installing a basic oxygen mill was a fraction of that of the open-hearth; secondly, the time of production was tremendously different—where originally the open-hearth took eleven hours to process the iron ore into steel, or perhaps one-half of that time if the Bessemer process was used, the basic oxygen production actually took from twenty to thirty minutes and a much shorter time for the preparation of a new melt as soon as the furnace product was tapped; and thirdly, the finished product of the basic oxygen process was facile, at least comparable in quality to that of the open-hearth, and could be produced within various compositions.

Certain changes of ownership occurred in the patent rights during the early years. In this country assignees of the Suess patent rights entered into an agreement with Kaiser on May 20, 1954 (PX-5 B & C) by which Kaiser was granted all licensing rights for the use of the Suess process throughout the United States. On November 12, 1954, Kaiser entered into an agreement to give know-how, engineering knowledge and consultation services concerning the process to McLouth at a cost of $100,000. (257 F. Supp. at page 385). In their main brief the plaintiffs at *McLouth* (PX-K-1 at page 15) stated that negotiations with Kaiser and McLouth continued until November 19, 1954, at which time McLouth accepted a proposal that Kaiser was to provide McLouth with know-how relating to the process in issue, **[26]** including drawings, engineering and metallurgical data, consulting services and advise and general supervision over the initial stages of the operation. Kaiser agreed to review in detail the design of McLouth's converters and to provide persons who would assist in training McLouth's operators and establish good operating practices during the initial phases of the operation. Kaiser also granted McLouth an option to obtain a license under the patents covering the process. In the

meantime, McLouth being skeptical of the Suess patent's efficacy built a duplexing plant in the event that this process under the Suess patent proved to be a failure. However, with the total success of the patent process, McLouth disassembled the duplexing plant and produced steel by the oxygen application method. (257 F. Supp. at page 399). With McLouth's failure to perform according to the contract, the plaintiff Kaiser entered suit to recover damages for patent infringement. McLouth argued unsuccessfully that a licensing agreement had been entered into. When this issue was ultimately decided against McLouth, the patent infringement trial commenced. In a similar manner, one *J & L* case involves a licensing agreement which is not contested here. Thus, in *J & L* the issues are breach of licensing agreement and patent infringement.

McLouth raised a series of defenses, the relevant one here being (1) that the Suess patentees were not the inventors of the process but had copied the prior art of Schwarz and Miles; [27] (2) that McLouth was manufacturing steel in their basic oxygen furnace vessels by means of deep penetration of the oxygen into the molten metal bath according to the prior art of Schwarz; and (3) that the specification and claims of the patent in suit did not comply with 35 U.S.C. § 112.

On February 4, 1956, (PX7A) the defendant J & L in these proceedings entered into an agreement with Kaiser for the construction of a basic oxygen plant at its Aliquippa works and for instruction on the know-how of the procedure of the process as well as for licensing. J & L paid the first payment of $285,000.00 (PX472, p. 1203) and thereafter refused to abide by the Agreement. Additionally, J & L installed a basic oxygen furnace at Cleveland, Ohio without any agreement. In response to plaintiffs' suits concerning these, J & L in essence adopted the McLouth defenses; that the Suess patent had been anticipated by Schwarz and Miles; that J & L used deeper penetration

than did the Suess experimenters in June 1949; and that because the the plaintiffs were not the owners of any process either by invention or assignment, they had no patent rights against the defendant. Other defenses were raised which are not at this time material. Thus it is obvious that these consolidated J & L cases involve the identical subject matter as the *McLouth* cases.

In its Opinion dated July 6, 1966, the McLouth District Court found that the Suess et al. patent was not anticipated by prior art; that it was not obvious to prior art except insofar as chemical [28] reactions occurred within the interior of the bath; that the prior art did not provide utility; that the Suess et al. patent did provide utility; that the Suess et al. patent was a revolutionary invention; that the intermediate impact pressure of the oxygen jet upon the molten metal bath surface was the gist of the invention, because it avoided the deep penetration of the prior art; that the applicants had originally claimed "avoidance of deep penetration" as the gist of their invention, but that subsequently they abandoned this terminology in favor of "to such an extent as to avoid material agitation of the bath by the oxygen stream" with which there was no casual connection; and that accordingly the patent was invalid. (257 F.Supp. at page 372).

The *McLouth* District Court in relevant part, ruled:

> "Therefore, the well-established doctrine of file wrapper estoppel prohibits a construction of the claims finally approved by the Patent Office as containing a concept expressed in language previously rejected by the Patent Office and then abandoned by the applicants." (257 F.Supp. at page 427).

Ultimately its judgment of invalidity was based upon the fact that:

> "In this Court's opinion, the Suess et al patent in suit, No. 2,800,631, is invalid under 35 U.S.C. § 112 for failure of the claims to particularly point out and

distinctly claim the subject matter which the applicants regarded as their invention." (257 F.Supp. at page 442)

On appeal by the plaintiffs the Court of Appeals for the Sixth Circuit disagreed almost entirely with the District Court, [29] but affirmed on the basis of the fact that the District Court had declared the Suess et al. patent invalid. (400 F. 2d 36, C.A. 6, 1968).

As noted above, the McLouth defense rested largely on two grounds: one, that Suess patentees did not invent the process which they claimed, and two, that neither the specification nor the claims of the patent complied with the requirements of the patent statute, 35 U.S.C. 101-112. However, these are divided into a large number of points concerning which the plaintiffs and the defendant offered evidence and arguments. A short resume of the prior art Schwarz and Miles is necessary to clarify the basis of these disputes.

The Schwarz Patent (DX-5A)

The first paragraph of the Schwarz patent reveals its theory and purported methodology. This reads as follows:

> "If liquid baths, for instance metal baths are to be treated with gases, it is important *to bring the reactants into as intimate contact with each other as possible. Surface contact is not sufficient* in most cases to produce a rapid reaction, such as the blowing of the gas over the surface of the bath or the mere blowing of the gas onto the surface of the bath. The blowing of the gas through the bottom or wall of the container and the bath or the *blowing of the gas into the bath* by means of a pipe *naturally results in substantially stronger contact of the reactants and thus a substantially faster reaction*, but in many cases it cannot be employed for technical and practical reasons." (Emphasis supplied) (DX5A, page 1, lines 1-10 and page 2, lines 1-2).

How the "intimate contact" of the gas and the metal is to be made is contained in the first sentence commencing on page 2:

[30] "The object of the present invention is a method of bringing gases into particularly *intimate contact* with liquid baths, for instance metal baths, by providing the jet of gas directed onto the surface of the bath *with such a high kinetic energy that it is capable of penetrating in the manner of a solid body deep into the bath* by the use of extremely high velocities lying preferably above the speed of sound. In this way it is possible, . . . to cause the jet of gas to act *within the liquid baths* so that the reaction takes place extremely rapidly and completely." (Emphasis supplied) (PX-A p. 2, lines 3-13).

The patent recites that it was known to the prior art that

". . . a high blast inlet velocity, possibly of a speed lying above the speed of sound is necessary, in order to conduct the air through the bath in as compact a jet as possible." (PX-5A, p. 2, lines 15-17).

However, this use was only known in introducing it in the bottom of the converters as

". . . it was not possible to obtain from this proposal the idea, when treating liquid baths, for instance metal baths, with gases, to cause the jet of gas to impinge on the surface of the bath with such a high velocity that *it was capable of penetrating into the bath in the manner of a solid body.*" (Emphasis supplied) (PX-5A, p. 2, lines 19-24).

So, too, it was known by prior art that alkali compounds could be introduced "in the form of a thin stream under the action of high pressure vertically or obliquely into a metal bath." (PX-5A, p. 2, lines 25-26, p. 3, line 1). However, it was not known that it was also possible "to conduct a jet of gas from above in such a manner onto a liquid bath *that it was* [31] *capable of penetrating into the interior of the bath.*" (Emphasis supplied) (PX-5A,

p. 3, lines 2-6). This method could be applied "for the refining of iron and steel melts." (PX-5A, p. 3, lines 20-22).

The patent recites that the various drawbacks, which are encountered by lateral blowing, are not encountered by this oxygen enriched air or oxygen method, and so rapid wear of the container liner is eliminated, because "local overheating and accumulation of ferrous oxide, takes place in the center of the steel bath and therefore the walls of the vessel are not substantially attacked." (PX-5A, p. 4, lines 19-25, p. 5, lines 1-2). It also results "in exceptional advantages, namely the speed of refining or decarburization of steel melts can be very considerably increased . . ." (PX-5A, p. 5, lines 4-12). The method also permits the introduction of "pulverulent solids" into the liquid bath by means of gases and provides "a good distribution of these substances . . . particularly in case of varying direction of the jet." (PX-5A, p. 5, lines 13-17). Evidently the reason that these advantages occur, the patent indicates, is because "The gas can in this case *exert an action* of its own *on the liquid bath*, but may also serve merely as vehicle and carrier for the solids." (Emphasis supplied) (PX-5A, p. 5, lines 17-19).

Thus, the jet was not only a means for conveying the exygen or oxygen enriched air pulverulent solids to within the bath, but **[32]** also to penetrate "in the manner of a solid body deep into the bath" and provide "a good distribution of these substances . . . particularly in case of varying direction of the jet." Thus Schwarz used the jet as a mixing device. It alleged an improvement particularly over the prior Bessemer and Thomas converters.

The Schwarz patent claims (1) a "Method of treating liquid baths, for instance metal baths, by gases directed against the surface, characterized by the fact that the jet of gas which is directed against the surface of the baths has *such a high kinetic energy that it is capable of pene-*

trating deep, in the manner of a solid body, into the liquid baths"; and (2) that "the jet of gas which impinges with high kinetic energy on the surface of the bath and *penetrates into same serves as vehicle and carrier for solids* which are to be introduced into the baths." (Emphasis supplied) (PX-5A, p. 5, lines 20-25, page 6, lines 1-6). Although the patent suggested a method, it did not provide any instructions for its performance.

The Miles Patent (PX 10-A)

The Miles patent was substantially similar to Schwarz, but provided considerably more detail and several possible methods of utilization. The most notable of these variations was that a liquid rather than gas jet be employed, the liquid having a greater potential for penetration. It also suggested that:

> "Several suitable jets located in the furnace can be used simultaneously and if desired each of them can be given a *vibrating motion* so as to [33] cover a larger surface of the bath. The jet serves to *circulate and agitate* the metal and slag." (PX-10A, p. 18, lines 5-9) (Emphasis added).

Miles, like Schwarz, also recommended the addition of "carbon . . . in the form of pulverized coal injected into the furnace at high speed either together with the oxidizing fluid or by separate nozzles." (PX-10A, p. 11, lines 11-13). It also suggested that "the heat can also be produced by suitable additions either to the jet or to the metal. Thus one can blow in, with the jet, or by other means, such as a separate gas feed, a readily oxidizable element (metal or alloy), that is to say an element which has a high heat of oxidation, such as carbon, silicon, aluminum, calcium, magnesium or other metals or alloys." (PX-10A, p. 15, lines 9-14).

Miles, like Schwarz, proposed by his method to obtain a high temperature *within* the interior of the bath and

suggested that the purpose for adding these oxidizable elements "is to increase the temperature locally where the jet strikes the bath so as to bring about the oxidizing action more rapidly." (PX-10A, p. 15, lines 15-16). Miles suggested a number of diverse applications in various vessels including Siemans-Martin or open-hearth furnace. The patent asserts that

> "In accordance with the invention, the refining process consists *in injecting into the molten metal*, by a blast, an oxidizing fluid at such speed that a sufficient proportion of the fluid *penetrates into the metal to react there* on the oxidizable impurities and eliminate them from the metal . . ." (Emphasis Supplied) (PX-10A, p. 2, lines 5-9).

The main idea of the patent may be found in these excerpts:

[34] "The oxygen-containing fluid can be projected from top to bottom onto the surface of the metal to be treated at such speed that the major part of the fluid jet *penetrates into the bath*. The velocity of the fluid at the surface of the metal required to cause this substantially *complete penetration* must necessarily vary in accordance with the circumstances in each case." (Emphasis supplied) (PX-10A, p. 2, line 21, p. 3, lines 1-5).

"The speeds of this order of magnitude are desirable in order to obtain an optimum penetration and effect of the fluid . . ." (PX-10A, p. 3, lines 11-13)

"The high speed of the fluid jet has the effect that the *source of chemical oxidation reactions is located within* the bath at a good distance from the refractory lining of the furnace." (PX-10A, p. 3, lines 17-19).

"The penetration of the jet also fulfills the useful function of *agitating the bath*, so that the reactions take place uniformly and to the maximum extent." (Emphasis supplied) (PX-10A, p. 4, lines 4-6).

In the case of applying the process to the Martin furnace (open-hearth), the statement is made that

> "The jet is directed from top to bottom upon the surface of the metal at a velocity which is sufficiently high to assure the penetration of almost all the fluid into the bath. The *jet serves to maintain a vigorous agitation* so that the oxidizing reactions follow one another *in the interior of the bath* at a very high speed and with a very high chemical yield of oxygen." (Emphasis supplied) (PX-10A, p. 10, lines 3-8).
>
> "The high speed jet causes *a vigorous agitation* and an entrainment of the slag *in the body of the metal*, thus assuring *an intimate mixing and rapid* reactions." (Emphasis supplied) (PX-10A, p. 13, lines 11-13)

Certain specifics are set forth in Miles which are absent in Schwarz. For example, Miles taught: (1) the blast so to be injected into the molten metal as an oxidizing fluid containing **[35]** not more than 30% nitrogen and a quantity of oxygen between 70% and 98% (PX-10A, p. 2, lines 5-11); and (2) that it is "desirable in order to obtain an optimum penetration and effect of the fluid" and to provide "a nozzle of 0.32 inches inside diameter, the tip of which is 6 inches above the surface of a bath of molten cast iron requiring a gas pressure of 7 or 8 atmospheres to deliver about 10,000 cubic feet of gas per hour into the bath at a speed of about 1250 feet per second" (PX-10A, p. 3, lines 6-13).

Miles says that "the preferred percentage of nitrogen is between 5% and 25% and at the present time the cost of oxygen which contains this percentage of nitrogen is relatively low and *does not prevent the industrial application of the invention.*" (PX-10A, p. 5, lines 2-5) (Emphasis supplied). (3) It further provides that the nozzle be placed "at any angle between 15° and 90° with respect to the horizontal, but preferably between 30° and 75°, . . ." (PX-10-A, p. 17, lines 11-12); (4) ". . . while the distance from the jet to the metal and/or the slag should be between 1 and 20 inches, preferably between 4 and 12 inches." (PX-10-A, p. 17, lines 12-14).

A series of 17 claims incorporate "A process for the refining of molten metal by the projecting of an oxidizing fluid into the metal at a velocity such that a sufficient proportion of the fluid penetrates into the metal to react there with the oxidizable impurities of the metal"; it is "characterized by the fact that the fluid employed does not contain more than 30% nitrogen and a proportion of oxygen between 70% and 98%"; that **[36]** "the fluid is projected into the metal at a velocity which is not less than 1250 feet per second"; it is further characterized by the fact that "the oxidizing fluid is used as a vehicle to bring a heat-generating substance such as a carbonaceous material *into* the bath"; and it is also characterized by the fact that the process may be applied in various kinds of converters. (PX-10-A, pp. 20-23).

It is not necessary to detail here all other matters set forth in the Miles patent. Yet certain pertinent similarities, as well as differences, do exist with Schwarz as well as with Suess.

The important fact here is that in both Schwarz and Miles patents the jet or jets were to be used as devices for mechanically agitating or stirring the bath and thus as activating the oxidation reactions for the iron refinement within the bath. In both processes additives were included to produce the high temperature within the interior of the metal bath (Schwarz, PX-5-A, p. 4, lines 24-25); (Miles, DX-10-A, p. 3, lines 17-18). Each viewed the process as a speedy method of refining iron into steel. Each claimed that high temperatures were created within the interior of the bath, and that accordingly, the refractories remained undamaged.

There is no evidence in the *McLouth* record, if in fact any does exist, of the quality of steel which either Schwarz or Miles produced. However, it must be presumed that since oxidation would naturally take place within the molten metal bath that a certain amount of refinement of the crude iron would **[37]** result. There is, however, undisputed evi-

dence from certain of the plaintiffs' witnesses, and from one of the defendant's witnesses, Dr. Durrer, that the Schwarz patent did not produce practical results. (PX-510, p. 5085). He likewise testified that the Miles patent did not yield practical results (PX-510, p. 5085).

There is considerable evidence in the *McLouth* record that the forced activation of the jet in Schwarz and Miles did considerable damage to the refractories, particularly to the sidewall opposite that from which the jet initiated. This is better exemplified in the experimentation of Dr. Durrer and Dr. Hellbruegge at Gerlafingen, since the testimony is undisputed that these two experts were experimenting during the years 1948 and 1949 in accordance with the processes of Schwarz and Miles.

Gerlafingen—Durrer & Hellbruegge

As general manager of Von Roll from 1946-1951, Dr. Durrer lived in Gerlafingen (R. 5004). In 1947, he called on Dr. Hellbruegge to work with him in Gerlafingen, because as Hellbruegge stated, "I had been his assistant, and I had devoted my time to the utilization of oxygen in the making of steel, and this had been the reason why Professor Durrer had called me." (R. 4524).

At Gerlafingen, Hellbruegge's work centered around top blowing with oxygen (R. 4525; 5013). In May of 1949, Trenkler went to Gerlafingen to observe the work being performed there (R. 4532-33; 5016). While there he observed the use of a bent water-cooled lance with a Laval tip (R. 4552; 4561). Hellbruegge **[38]** testified that he told Trenkler that the "lance was to impinge upon the bath in its center." (R. 4596). Both Durrer and Hellbruegge testified that they told Trenkler that the steel they were producing was comparable to open hearth steel (R. 4600; 5026). It was thereupon decided that the Gerlafingen work should be reproduced at Linz (R. 5026).

Dr. Durrer testified that the problem of refining with high purity oxygen had been solved in principle at Gerlafingen (R. 5025). Not only is this conclusion extremely ambiguous and overbroad, it appears to be contradicted by the fact that Durrer sent a congratulatory letter to Suess on May 5, 1950 (DX-251-E) stating:

> "I had not expected you to be able to solve this problem so quickly, and am therefore all the more delighted, now that I have been able to see the beautiful results with my own eyes. Now that the problem has been solved in principle . . ."

and a memorandum of a discussion with Dr. Suess on December 10, 1949 (DX-110-E).

Furthermore, during a speech at Leoben in May 1949, Durrer urged investigating the conversion of iron into steel by high oxygen fluids. Specifically, he stated, "these ideas are still in the developmental stage, but already they indicate the direction which should be taken." (R. 5097-98). Furthermore, in a letter dated May 28, 1949, Durrer spoke of refining pig iron by blowing oxygen as the "great problem." (R. 5099).

In order to understand the attitude of Dr. Durrer as he testified for the defendant McLouth, we refer to this in the District Court Opinion:

> [39] "Dr. Durrer testified at the trial that the Schwarz patent contained his ideas. (R. 5101.)
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> • • • • • • • • • •
>
> Dr. Durrer affirmed the similarity of his teachings to those of the Schwarz patent, regardless whether Dr. Durrer himself was the true inventor of the process claimed in the Schwarz patent. (R. 5100-5101.)" (257 F. Supp. at page 408).

The Opinion comments that there was disputed evidence regarding the solving of "Gerlafingen problems of refractory damage," and remarked that Dr. Hellbruegge in his

Stahl and Eisen article (DX-61, p. 14) stated that in the Gerlafingen operations there were no difficulties with respect to the durability of the nozzle, nor of the converter. The District Court Opinion then said

> "On the other hand, Dr. Trenkler testified that he was told at Gerlafingen that Dr. Durrer and Dr. Hellbruegge had initially encountered difficulties concerning an insufficient life of the nozzle and an extremely short life of the refractory lining lasting only one to two heats." (257 F.Supp. at page 414).

The Opinion then adds that the early experimentation of the patentees consisting of the June 17th series of tests confirmed that problems of refractory damage existed at Gerlafingen, and "had not been completely solved." (257 F.Supp. at page 414).

The Opinion also remarks on the doubtful success at Gerlafingen since Dr. Durrer had testified at the *McLouth* trial that Schwarz' work gave no practical results in the refining of pig iron into steel by the oxygen method. Thus, since Dr. Durrer's ideas were contained in the Schwarz patent and as it was followed at Gerlafingen, those ideas "would also have led to no practical results." (257 F.Supp. at page 417). Further comment is made that neither Dr. Durrer nor Dr. Hellbruegge apparently sought a patent themselves on the basis of the Gerlafingen **[40]** tests and neither did Dr. Durrer's company. And yet being aware of the Suess patent applications in Austria and Switzerland, no oppositions to the Suess applications were filed anywhere in the world. (257 F.Supp. at page 417).

Persuasive evidence comes, however, in communications from Dr. Durrer as he registered surprise at the good results of the Linz work and declared in his December 14, 1949, memorandum (DX-110-E) that "This work shows a new metallurgy with which we must first of all become acquainted. Presumably, the extensive removal of these substances is due to the higher temperature, the higher degree

of liquidity connected therewith, and the higher reaction velocity resulting therefrom." (257 F.Supp., p. 417). This is corroborated by the letter of congratulations dated May 5, 1950 (DX-251-E) when Dr. Durrer wrote to Dr. Suess and stated, inter alia,

> "I had not expected you to be able to solve this problem so quickly, and am therefore all the more delighted, now that I have been able to see the beautiful results with my own eyes. Now that the problem has been solved in principle . . ."

The prior art, knowledge and accomplishment culminated in this work at Gerlafingen prior to the beginning of experimentation by the patentees at Linz, Austria in June 1949. Thus, for whatever the Gerlafingen experience might have contributed, the *McLouth* record evinces no basis for the patentability of the methods practiced there.

[41] *Suess et al. Application and Claims (PX-2)*

The Suess et al. application and claims for which a patent was finally granted on July 23, 1957, may be divided into several parts.

First, in the first two paragraphs of the first column, the general adaptability of the patent is set forth;

Second, in the balance of the first column and through line 35 of the second column, the prior art knowledge of pneumatic blowing in refining iron processes and its attempts with high purity oxygen in the refining of the molten metal charges, as well as its failures, are outlined;

Third, the objects of the patent are enumerated in the balance of the second column and continuing on into the third column through line 15;

Fourth, in the balance of column three and continuing through column 12 to the claims, the description of the process, findings, instructions, theories of why and how

the process functions, comparisons to other processes and examples, and results, are set forth;

Fifth, the claims are stated.

In the first division, the patent states,

> ". . . the invention relates to a process for the refining of molten metal with high purity oxygen blown downwardly onto the surface of a bath of the molten metal" (Col. 1, lines 21-24).

Under division two are summarized the attempts to blow high purity oxygen in Bessemer and Thomas converters with the **[42]** resulting destruction of the refractory bottom within a short time of one heat, and attempts that were made to blow high purity oxygen from tuyeres positioned in the walls of the vessel above the melt line.

> ". . . the horizontal velocity component of the oxygen jet as the melt surface [caused] the development of excessively high temperatures above and at the melt-slag interface on the side of the vessel opposite the tuyeres or oxygen jet inlet so that a rapid deterioration of refractory occurs." (Col. 1, lines 49-54).

Additionally, a loss of oxygen efficiency resulted due to the deflection of the gas from the melt surface.[8] More than sufficient heat resulted which interfaced with the chemistry of the process, the life of the refractory lining being severely curtailed, so that they had to be restored after a short period of use. And so, "there remains no economical, commercially feasible process for refining of molten metal with high purity oxygen capable of providing long refractory life and high oxygen efficiency." (Col. 2, lines 25-28).

Under division three, the object of the process is to move the reactions between the oxygen gas and the molten metal and limit them to "an oxygen jet impingement area removed from the refractory lining of the reaction vessel"

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[8] (Col. 1—lines 55-56)

(Col. 2, lines 50-52). Another object is to provide "controlled refining at substantially theoretical oxygen efficiency" (Col. 2, lines 56-57). Further goals are to provide "an exceptionally high refractory life." **[43]** (Col. 2, line 61), and "to provide a process of surface blowing molten pig iron with high purity oxygen" for the avoidance of an "over-oxidation of the molten pig iron bath." (Col. 2, lines 63-68). The process also is to provide a high purity oxygen method for "widely varying chemical compositions" in pig iron used in ordinary basic open-hearth practice, acid Bessemer and basic Thomas converters *"to produce steels having analyses and qualities at least comparable to that of basic open-hearth steels."* (Col. 2, lines 69-72, Col. 3, lines 1-5). (Emphasis added), and "to provide a high purity oxygen refining process for production of steel of excellent quality at a high rate of production" comparable to that produced in the Bessemer or Thomas converters. (Col. 3, lines 5-12).

Under the next division, the process is explained as one in which "the high purity oxygen jet is blown vertically, or approximately vertically upon the central portion of the surface of a bath of the molten metal" with a jet having a diameter and static pressure as is later specified and spaced from the bath surface such that direct contact of the oxygen jet and the molten metal is established and maintained throughout the refining period without deep penetration of the molten metal bath by the jet. (Col. 3, lines 36-47). Thus, the patent asserts that "the area of *jet impingement is controlled to produce a relatively confined zone of direct oxygen to molten metal contact* with respect to the total surface area of the bath." (Emphasis supplied) (Col. 3, lines 46-49). Thereafter, there is **[44]** detailed instruction on the static pressure and the overhung blast nozzle and the indication that it "produces a sufficiently high reaction velocity of the oxygen with the bath constituents to insure the development of autogenous heat a at rate sufficient to provide the heat required for completion of the refining in

a minimum of time, consistent with controlled temperature and control and development of other necessary and required process conditions, such as fluid slag, avoidance of over-oxidation (undue loss of iron to the slag), and avoidance of slopping." (Col. 3, lines 49-72).

Thereupon it is stated that "*the process conducted under these conditions avoids a deep penetration of the oxygen gas into the molten bath* which seriously impairs refractory life at the bottom of the refining vessel. In addition, the impingement area of the high purity oxygen on the central portion of the bath isolates the refractory walls of the refining vessel from the *extremely high temperatures which are developed by the direct reaction of the oxygen and the molten metal.*" (Col. 3, lines 73-75, col. 4, lines 1-6) (Emphasis added). Further it is asserted that "according to the invention . . . the utilization of suitable design of reaction vessel and the use of the proper amount of material charged results in a ratio of the depth of the bath to the surface area of the bath which augments the protection afforded to the refractory lining of the refining vessel and is also beneficial to the progress of the refining reactions *to produce finished steels of low impurity content* **[45]** *comparable to those produced by the basic open-hearth process.*" (Col. 4, lines 7-15) (Emphasis added). Numerical illustrations are made for the provision of a vessel so as to contain a ratio of bath depth to surface area in square meters of from about 1 to 5 to about 1 to 28, or specifically in the case of a circular bath a ratio of depth to diameter of from 1:2.5 and 1:19 with similar ratios for other sized vessels. (Col. 4, lines 15-25).

In the next paragraph the patentees hypothesize their theory of circulation in the following words:

> "Although it is not intended to limit the present invention to any specific theory of action or mechanism, it is believed that application of the oxygen jet substantially vertically or approximately vertically upon the central portion of the bath surface brings about a flow in the

molten metal from the center of the surface of the bath downwardly and then along the bottom of the refining vessel, and upwardly at the sides of the vessel to the surface of the bath, so that portions of the unrefined metal are continuously presented to a localized center of direct oxygen reaction with the bath metal, while reacted or oxidized portions of the bath move away from this reaction center. This apparent circulation of the molten material is facilitated by shaping of the bottom of the device in its refractory lining in a uniformly curved design, preferably hemispherical or similar shape, so as to offer the minimum of resistance to the circulation." (Col. 4, lines 26-42).

The patentees proceed to a declaration of the scientific action which is produced upon "initial contact of the high purity oxygen jet with the molten metal bath":

"Due to the very high affinity of oxygen for iron, initial contact of the high purity oxygen jet with the molten metal bath causes a rapid combination of oxygen and iron to form FeO in the confined central reaction zone. This is demonstrated by ignition of the oxygen and the propagation of a visible flame within the first minute of blowing. This reaction, **[46]** together with oxidation of impurity elements, such as silicon and manganese, develops extremely high temperatures in the zone of direct oxygen contact with the molten metal which approach the boiling point of iron, as demonstrated by the evolution of a fume containing iron oxide and manganese oxide. A portion of the iron oxide goes to the slag with the other oxidized elements and a portion diffuses into the bath under the influence of the bath circulation, so that within the first three minutes of the blowing vigorous carbon combustion is initiated due to the high temperatures developed by these reactions. The ensuing reaction of carbon with the FeO and directly with the oxygen gas in the confined direct oxidation zone causes rapid formation of carbon monoxide and the formation of this CO causes a strong boil or agitation of the bath, which augments the bath circulation to continuously present unrefined metal to the oxygen gas reaction zone and to create a slag-metal emulsion. The oxygen jet thus contacts the emulsion

of bath and slag components which presents a larger reaction surface and causes the refining reactions to progress rapidly although the oxygen jet does not penetrate deeply into the molten metal bath and is confined to an impingement area at the central portion of the bath surface. This vigorous boiling action is opposed by the pressure of the oxygen jet only in the area of impingement, and outside of this area it represents primarily endothermic reduction of FeO by carbon to form the evolved carbon monoxide, which reaction thus effectively encompasses the zone of direct oxygen reaction at which the highest temperatures prevail affording a maximum measure of protection to the refractory lining of the refining vessel." (Col. 4, lines 43-75, Col. 5, lines 1-5).

In the next paragraph comparative examples are given of the longer life "In conducting the process and in the manner set forth above" of over 200 heats as against 35 to 60 heats in the Bessemer converter process and of total refractory consumption in the instant process of about 24 pounds of refractory brick per ton of steel as against 36 pounds of refractory brick per ton of steel in the open-hearth process. (Col. 5, lines 6-29).

There follows an explanation of the calculated oxygen [47] efficiencies as well as an explanation of the resultant chemical effects produced by "efficient utilization of oxygen" (Col. 5, lines 30-59). The relationship between chemical reactions and the localization of the reaction zone is explained:

"*As above mentioned, it is a characteristic of the process of the invention that in the confined zone of direct oxygen reaction at the surface of the molten metal bath,* the oxidation products of the impurities in the pig iron, such as silicon and manganese, as well as the oxidized iron form an early fluid slag which is always very rich in oxides, that is, highly oxidizing. With the formation of the slag-metal emulsion, the iron oxide reacts with the carbon present in the bath, primarily outside of the direct oxygen-metal reaction zone, and since such

slag-metal reactions are endothermic, the molten bath is maintained cooler in the vicinity of the walls of the refining vessel or converter. For example in the formation of one kg. of FeO, by direct oxidation with the oxygen jet and absorbed as iron silicate into the slag, 80 kg. calories of heat are developed. An equal amount of heat is absorbed outside of the confined central zone of direct oxidation as the FeO (as silicate) is reduced by the carbon in the bath, as one example of slag metal reactions occurring during the blowing." (Col. 5, lines 60-75, Col. 6, lines 1-4). (Emphasis added).

In the next two columns the patent states that "formation of an early highly oxidizing fluid slag is of particular value in basic refining when the process applied to pig iron of analyses used in ordinary open-hearth practice, which would not be amenable to refining by either the acid Bessemer process due to the phosphorus content, or the basic Thomas process due to the lack of sufficient phosphorus." (Col. 6, lines 5-11). Thereupon instructions and explanations are given for the addition of lime, or lime supplying substances in the treating of "normal open-hearth pig irons" having **[48]** specific phosphorus or sulfur contents with some attention to the manganese contents. (Col. 6, lines 11-51). The next paragraph instructs upon the purity of the oxygen to be used. (Col. 6, lines 52-61).

The patentees further discuss the chemical reactions as they abate when oxidizable matter is exhausted, and the oxygen jet becomes effectually impotent.

They state:

"The vigorous boil, above mentioned, continues up to the carbon end point, and together with the induced circulation of the bath metal toward and away from the central zone of direct oxygen reaction, effectively counteracts any tendency to overoxidation of the bath. When the flame dies and carbon combustion is completed, the bath becomes relatively quiet and intimate contact between slag and metal bath ceases. The turbu-

> lence of the bath and slag due to the oxygen stream impinging from directly above is insufficient to cause continuance of oxygen-metal reactions." (Col. 6, lines 62-72).

This is followed by an explanation on the oxygen content of the finished steel according to certain percentages and this statement:

> "Thus, the oxygen content of steels produced by the high purity oxygen blowing process *compare very favorably with oxygen contents of basic open-hearth steel* in the same carbon range, and are definitely lower in oxygen content than bottom blown Bessemer steels using air, oxygen enriched air, oxygen and steam, or other gas mixture." (Col. 7, lines 2-8). (Emphasis added).

The next paragraph deals with silicon, and the fact that pig irons with higher silicon are actually advantageous in this method of steel blowing:

> "As in the basic Bessemer process, the silicon is rapidly eliminated. However, in contrast **[49]** to the basic Bessemer process, the use of high silicon charges presents no problem due to the fact that slopping is not encountered in the process of the invention to any degree similar to that in the bottom blown Bessemer practice. In fact, higher silicon pig irons actually are advantageous in the high purity oxygen blowing due to the heat producing effect of this element in the early stages of the blow with the result that higher scrap charges can be made in the process." (Col. 7, lines 9-18).

The patent instructs on the quantity of scrap additions which may be used depending upon the silicon content of the pig iron. (Col. 7, lines 19-26). Thereafter, "the manganese content of the fully blown metal and of the slag" is discussed as well as chemistry in relation to carbon and without the addition of more manganese. It is stated, "Nevertheless, it is evident that due to the extremely high temper-

atures developed in this high purity oxygen process, a manganese recovery is possible which cannot be reproduced in known processes." (Col. 8, lines 15-19). Examples of three heats are given with the variable compositions of pig iron (without ferromanganese or deoxidizer). And thereupon, this statement is made:

> "From the foregoing test, it may be seen that manganese recovery at least 10 times as high as the final carbon content in the finished steel is obtainable by the process of the invention utilizing pig iron having manganese on the order of 3%." (Col. 9, lines 35-39).

The next paragraph concerns iron recovery economy and is summed up in the statement that,

> "With mechanical losses averaging about 0.8%, the percentage recovery of the refining process is approximately 90%, *comparable to the yield* **[50]** *obtainable by the basic open-hearth process.*" (Col. 8, lines 43-46). (Emphasis added).

The percentage changes of the FeO in the slag as the blow continues is explained (Col. 8, lines 40-60).

The patent proceeds to explain the oxygen requirement and particularly as it "insures satisfactory rereduction of FeO from the slag, in the manner set forth above." Exemplification is provided in that "refining to usual carbon end points on the order of 0.05% C is completed in from about 15 to about 30 minutes, preferably 18 to 22 minutes." (Col. 8, lines 61-75, Col. 9, lines 1-3).

The next two paragraphs discuss blowing. In the first paragraph there is set forth "exemplary commercial practice with 30 ton converters charged to 35 to 36 tons, oxygen pressures at the blast nozzle of about 8 to 10 atmospheres and oxygen jet or blast nozzle diameters of from about 27.5 to 35 millimeters (1.1 to 1.4 inches) with nozzle spacings varying from 25 to 50 inches (about 650 to 1250 millimeters have been used, the preferred spacing being from 30 to

40 inches (about 750 to 1000 millimeters)." (Col. 9, lines 6-13). It concludes:

> "In general, it may be stated that as the oxygen pressure and nozzle diameter are increased, the nozzle spacing is also increased, for example, as the capacity of the refining vessel and total charge is increased. Under these conditions, deep penetration of the molten metal bath is avoided, while the necessary displacement of the slag cover to maintain direct oxygen to molten metal contact is insured. However, in the unusual circumstances of an abnormally stiff slag cover, the blow may be initiated using mechanical means for penetrating the slag cover to establish oxygen to metal contact." (Col. 9, lines 13-24).

[51] With this kind of blowing under certain circumstances the rate of oxygen input may be reduced in the last few minutes of the blow, and this supports "the inherent characteristic of the process in regard to avoidance of over-oxidation of the heat." Accordingly, "it is generally unnecessary to utilize any deoxidizing agents such as ferromanganese and ferrosilicon in the production of semi-killed steels, and only in the production of killed steels are the conventional deoxidizers employed." (Col. 9, lines 25-37). It is taught that one of the process's major advantages is its applicability to pig iron of analyses used in ordinary open-hearth practice which are not amenable to refining by either the acid Bessemer or basic Thomas process. Additionally, the process is applicable to pig iron having analyses of the type which are normally used in either the acid Bessemer or basic Thomas processes. Illustrations are thereafter given. (Col. 9, lines 38-69). A description is given for an exemplary method of carrying out the present invention. (Col. 9, lines 70-75, Col. 10, lines 1-14). Further information is given on the character of the converter for the "preferred commercial practice of the invention" (Col. 10, lines 15-22). After all of these explanations and instructions an example is set forth (Col. 10, lines 29-75).

That the process provides for variable uses is set forth in Col. 11.

Following all these explanations and instructions the patentees make two claims. In light of the current law and the prior proceedings, the claims represent the hub of the **[52]** controversy in the case. Accordingly, I reproduce these here *in toto*:

> "We claim:
>
> 1. Method of refining molten impure iron in the presence of a slag in a vessel having a refractory lining by blowing with oxygen, which comprises discharging a stream of oxygen vertically downwardly through the slag layer onto and below the surface of the bath at the central portion thereof, *to an extent to avoid material agitation of the bath by the oxygen stream*, the contact of the oxygen with the bath resulting in reaction of the oxygen with a portion of the iron and with the oxidizable impurities of the bath *in a localized reaction* zone spaced a substantial distance from the refractory lining, the reactions in said zone resulting in refining of the iron and gas evolution and in the production of high temperature in the reaction zone away from the refractory lining, said reaction producing a circulatory movement in the molten metal, which circulatory movement brings those portions of the molten metal bath which are remote from the reaction zone into the reaction zone whereby those portions are subjected to said reaction with minimum injury to the refractory lining.
>
> 2. The gaseous oxygen process set forth in claim 1 in which the oxygen is blown into said vessel under pressure in a range between about five and about twenty-five atmospheres above normal atmospheric pressure." (Emphasis added) (Col. 12, lines 9-33).

The *McLouth* plaintiffs asserted that there existed a chemically induced down in center circulation as a part of the process, but that the *McLouth* defendant's contended that this circulation was not set forth in the claims. The patent specification leaves little doubt that the patentees

disclosed that a circulation was created and existed by reason of the process. I recognize that there is no definitive statement in the specification of the exact direction of circulation. In one place, however, the specification does refer to the ensuing reaction of the carbon with the FeO which results in the [53] formation of carbon monoxide, which in turn, "causes a strong boil or agitation of the bath, which augments the bath circulation to continuously present unrefined metal to the oxygen gas reaction zone and to create a slag-metal emulsion" (Col. 4, lines 60-67).

For the present we only keep these matters in mind so that we may better understand the issues as they arise in this regard.

Thus, the prior workers, including Schwarz, Durrer and Miles, struck upon the ideas that better contact was obtained by the stirring action if the jet of oxygenated air or liquid was not injected from the bottom or at the sides of the bath as practiced in the Bessemer and Thomas process, but rather from the top onto the surface and into the bath. They also found that rapid conversion occurred. These inventors, however, faced two critical drawbacks for practical operation: they could not control the quality of steel obtained, and they could not prevent the destruction of the refractories or lining of the vessels.

The instant patent makes clear the fact that it is a double reaction which takes place: first, in the confined zone of the oxygen jet impingement at the surface area where the heat of the process is *generated* (Col. 4, lines 43-75; Col. 5, lines 1-5; Col. 6, lines 62-72); and second, in the area surrounding this where the heat is *absorbed* by another character of [54] chemical reaction. (Col. 4, lines 43-75; Col. 5, lines 1-5; Col. 6, lines 62-72).

The information which we derive from the patent specification is that after the oxygen to metal impingement is made, the ensuing reactions flow from the natural laws

of chemistry. Thus, all that the steelman need do is provide the instructed elements to produce the chemical action and reaction which occurs upon the impingement of the oxygen jet on the metal surface.

Summary of Schwarz, Miles and Suess

From the study of these three patents, we now see the difference of the Suess et al. theory from that of Schwarz and Miles. In Schwarz and Miles a stream of oxygen, oxygen enriched air, liquid (as in the case of Miles), or pulverulents is injected within the bath to provide a stirring or agitation effect for the purpose of procuring "intimate contact" of the oxygen within the interior of the bath. The theory of Suess was to provide only oxygen to metal surface contact impingement producing a hot center surface reaction area. This area, in turn, was surrounded by or imbedded within, the cooler, heat absorbing remainder of the bath.

From my study of the process, I have learned that the Suess process separated the prior art processes of Schwarz and Miles into two phases. Where the prior art contained the entire chemical reaction within the interior of the bath, Suess [55] instructions provided for two different but interrelated chemical phases. One of these described in chemistry as "exothermic,"[9] and is characterized by or formed with evolution of heat. The second reaction, "endothermic,"[10] is characterized by or proceeds with absorption of heat.[11]

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[9] Webster's Third International Dictionary, Unabridged, 1971 at page 798.

[10] (Id. at page 750).

[11] Although I have discussed the technical aspects of these two chemical reactions, I can here, for a faster understanding of these, illustrate by the boiling of water on the kitchen range. The gas flame of the burner represents the exothermic chemistry by reason of the fact that the gas (hydrogen) is being burned (oxidized) and

By its process the Suess Patent teaches controlled mechanical vertical impingement of the jet at the central surface of the molten bath, and thus causes the chemical reaction to proceed unimpeded. By such teachings it alleges it avoids deep penetration (taught by Schwarz and Miles) and material agitation (taught by Miles).

The questions presented in these actions and previously in the *McLouth* action would never have accrued had Schwarz, Miles or the men at Gerlafingen presented a practicable, utilizable process to industry.

[56] **II. The Sua Sponte Issue**

The *sua sponte* issue was raised here by the plaintiffs based on the *McLouth* District Court holding that "... the applicants *abandoned* the use of language referring to the avoidance of deep penetration and later chose to submit the language of the claims as finally approved by the Patent Office, resulting in the issuance of the patent in suit. Therefore, the well-established doctrine of file wrapper estoppel prohibits a construction of the claims finally approved by the Patent Office as containing a concept expressed in language previously rejected by the Patent Office and then *abandoned* by the applicants." (257 F. Supp. at page 427) (Emphasis supplied).

This finding was arrived at after the District Court had found that the original "Claims 1 through 4 of the continuation-in-part application, which expressly mentioned the avoidance of deep penetration as an essential feature of the claimed invention, were rejected by the Patent Office and later cancelled by the applicants." (257 F.Supp. at page 426).

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this reaction creates heat. The water in the kitchen kettle or pot will eventually approach the boiling point because it is absorbing the heat created by the burning gas—and this represents the endothermic or heat consuming chemistry.

The *McLouth* District Court expressed its opinion that the applicants should have pressed the claims in the Patent Office because it was convinced "on the state of this record that the 'new mental concept' of the patentees to avoid a deep penetration [57] of the bath by the jet was a patentable advance in the art of steelmaking, which explains the adoption of the Linz oxygen steelmaking process by steelmakers throughout the world." (257 F.Supp. at page 427).

The plaintiffs and defendant here stipulated that this determination was made by the District Court *sua sponte* without an opportunity on the part of plaintiffs to present rebuttal evidence. The plaintiffs here alleged that they had convincing evidence that would prove that there was no act of abandonment. Accordingly I permitted further hearings on that issue.[12]

The issues thus raised present an estoppel within an estoppel question:[13] Since the *McLouth* District Court raised the file wrapper estoppel issue *sua sponte*, are the plaintiffs here barred from further action on the basis of the doctrine of collateral estoppel? The estoppel question for me at the present time has now become a two-pronged inquiry: first, as it relates to the evidence presented by the plaintiffs here before me on the [58] question of whether or not the *McLouth* District Court properly invoked the file wrapper estoppel; and second, whether or not the plaintiffs, without any fault of their own, were deprived of the right to present evidence on the file wrapper issue so as not to be collaterally estopped under *Blonder-Tongue*.

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[12] It should be noted that this occurred prior to the *Blonder-Tongue* decision. See File Wrapper Estoppel record.

[13] That is, I must first dispose of the issue of file wrapper estoppel before an ultimate determination can be made on the issue of collateral estoppel.

The First Post Trial Hearing on File Wrapper

The issue raised by the plaintiffs that the District Court should not have made the file wrapper estoppel determination, *sua sponte,* was raised before me after the proceedings had been completed at Detroit. Additional evidence was presented here on April 29, 1970 relating to what transpired at a meeting in the Patent Office on May 1, 1957, when the Suess patent was under consideration.

At the April 29, 1970 hearing, the plaintiffs presented one witness and one deposition. The deposition was that of Claude A. LeRoy who was the Primary Examiner in Division Three of the Patent Office when the Suess et al. application was under consideration and who finally approved the wording in the claim, allowing the patent to issue. In his deposition (PX-1002) LeRoy testified that the policy of the Patent Office was to avoid the use of negative language in all claims to the extent such was possible (PX-1002, page 7, 11); that the concept of deep penetration was well understood in the art, but he believed [59] it would be more appropriate to emphasize the inventive feature of a localized penetration; and that he felt that the phraseology that the oxygen jet be blown to an extent "to avoid material agitation" of the bath by the oxygen stream was a more positive expression of the concept. He stated: (PX-1002, at pages 8, 9, 10):

> ". . . I thought that the language should try to bring out that the oxygen stream was confined or localized in the area somewhere near the surface of the bath. The deep language, the deep penetration, I thought, was well known in the art. It is a special penetration into the bath, but if you wanted to define this as being localized, I didn't like the language of 'avoid deep penetration.' So, I suggested that they use something to show it was localized in that area . . ."

He continued:

> ". . . we had considerable discussion as to the positive manner in which they would define that feature of hav-

ing the penetration extended down into the bath, just a rather insubstantial distance as far as the prior art was concerned. It was well understood in the art that deep penetration meant a considerable distance into the bath and they wanted to avoid that concept; so I tried to bring their—bring to their cognizance that it was a localized penetration and so the language that we finally adopted there was to bring out that feature."

The witness who testified here, at the first post-trial hearing, was Byron T. Gardner, Esq., who represented the [60] applicants at the May 1, 1957 meeting. He testified that the prior art and especially the Miles patent were discussed; that the Suess et al. process directs "the stream of oxygen in a much gentler fashion onto the surface of the bath through the slag on top of the bath and in such a manner as to create a localized area of intense heat and reaction . . . so the process was autogenous . . ." (FWE pp. 18-19); that "the agitation turbulence which characterized the Miles process was avoided" (FWE p. 19); that "the outer portion of the molten charge, instead of being hot, very hot, as in the case of the Miles operation, was relatively cooler than the reaction zone so that there was no erosion or little erosion as compared with the Miles process in the converter lining or walls" (FWE p. 19); that the choice of words "was a matter of definiteness, really. The scope so far as we were concerned, was not changed at all. We weren't giving up anything, didn't intend to give up anything." (FWE p. 24); that the distinction was one of language rather than substance (FWE p. 24); that the Miles patent contains the language "the jet serves to maintain vigorous agitation" (FWE p. 25); that the primary examiner [61] felt and said that "without material agitation" was a "more definite limitation, better defined the invention than 'avoidance of deep penetration' or 'without deep penetration' " (FWE p. 25); that he took this to be a distinction between the Miles patent and the one which was being presented (FWE p. 25); that the Schwarz patent was also discussed and

that the latter patent teaches that the penetration of the jet should be "deep, like a rod" (FWE p. 26); that there was no discussion of any limitation or abandonment; and, that the phrase " 'without material agitation' grew out of the fact that there was definitely an equivalency between low blowing rate and agitation and a high blowing or high velocity rate and deep penetration and agitation" (FWE p. 22) as the Examiner felt and as counsel agreed.

The defendant elected not to present evidence at the hearing on file wrapper estoppel.

Counsel for the plaintiffs argued that the lack of motive or opportunity to present evidence of what had occurred in the Patent Office was not a matter which could properly be raised in the *McLouth* appeal since an appellate court focuses almost exclusively on matters of law not fact. Thus, because **[62]** the plaintiffs erroneously believed that they would prevail on appeal as a matter of law, and because of the existence of the *Triplett* doctrine affording a plaintiff additional opportunities to re-litigate the factual merits of the patent, no attempt was made to reopen the Detroit record after the *McLouth* District Court filed its Opinion. Furthermore, it was indicated that an effort to reopen a record after the final merits disposition had been made, would have been an extremely unusual practice. (CE pp. 61-63).

The Blonder Tongue Post Trial Hearing

With the Supreme Court's rulings in *Blonder-Tongue* and after the defendant amended its answer to raise the question of collateral estoppel, a second post-trial hearing was held on September 7, 8 and 9, 1971. The evidence of the Primary Examiner and of the attorney for the applicants introduced at the first post-trial hearing was stressed, and additional evidence was adduced by the plaintiffs on file wrapper estoppel, and secondly on the issues raised under *Blonder-Tongue.*

On the question of file wrapper estoppel, the witnesses were David L. Ladd, lawyer and former commissioner of patents from 1961 to 1963; William E. Schuyler, Jr., a patent lawyer **[63]** and a former commissioner of patents from 1969 to 1971 and Robert B. Larson, a patent attorney and a former President of the American Patent Law Association in 1960-1961 and following that Chairman of the National Council of Patent Law Associations. On the question of collateral estoppel, Dr. John F. Elliott, Professor of Metallurgy of the Massachusetts Institute of Technology, who had testified as an expert at the *McLouth* trial, attempted to demonstrate the lack of technical understanding of the *McLouth* Courts.

The first witness, Mr. Ladd, testified that the Rinesch and Hauttmann affidavits (PX-2A) were included in the file history and would not have been obvious to anyone until the patent was issued, because until that time the entire contents of a file are unavailable to the public; but that upon issue, the entire file wrapper becomes public and nothing could possibly be obscured in the file (CE pp. 60-62), even though such an obscurity was determined to exist by both the *McLouth* District Court (257 F. 2d at 431) and the *McLouth* Court Court of Appeals (400 F. 2d at 50), or even seven years later as suggested by the District Court. He testified further that the **[64]** examiner in the Patent Office ordinarily consults the specification and the file wrapper in order to precisely ascertain the meaning of particular terms (CE pp. 70-71); that the Schwarz patent was voluntarily brought to the attention of the Patent Office (CE p. 89); that cancellation of a phrase and substitution of another is not an abandonment of the original concept (CE p. 113); and that the record disclosed that "the Examiner was aware of and applied the statutory provision of definiteness" (CE p. 156).

The testimony of William E. Schuyler, Jr., the Commissioner of Patents during a term from 1969 through 1971,

was in a large measure cumulative of Mr. Ladd's testimony. He did testify, however, that the final claims did not constitute an abandonment of the earlier language, but rather represented a more precise statement of the claims (CE p. 186); that Claim No. 16 which spoke of avoiding deep penetration was still pending when the new claims and affidavits were filed (CE p. 188); that the final terms of a patent are gradually arrived at through a give and take negotiation process between the examiner and the applicant (CE p. 189); that a failure to list Schwarz in the reference cited at the end of the patent, was not indicative of failure by the examiner to consider the Schwarz patent (CE p. 192); [65] that a change in the language of a claim does not constitute an abandonment of the concept (CE p. 205); that "Abandonment of language and abandonment of concept are two different things," and that in his expert opinion the applicants changed the language but not the concept (CE p. 231).

Robert B. Larson, patent attorney and President of the American Council of Patent Law Associations during 1960-1961, testified that in construing and interpreting a patent it is necessary to consider its entire file wrapper history (CE pp. 303-305); that when claims are rewritten an abandonment does not necessarily occur; that "The mere rewriting of a claim with the use of different phraseology in and of itself certainly does not constitute an abandonment of what was previously claimed" (CE p. 307); that where the file wrapper under certain circumstances indicates an abandonment, that would be different, "But mere language is not" (CE p. 307).

When asked:

> "Q. Where new claims however are submitted after the cancellation of the claims and there is nothing in the file history to indicate an intent to abandon, do the cancelled claims and the submitted new claims give rise to this matter of abandonment?

A. Oh, no, certainly not." (CE pp. 307-308)

[66] Mr. Larson testified that at the time the patentees canceled their original claims Nos. 1 through 4, they substituted Claim No. 12 which spoke of avoiding deep penetration. This showed the continuity of the concept and lack of any attempt to abandon it (CE pp. 317-318). At the time the supplemental amendment was filed on June 11, 1957, Claims 15 and 16 were still in the application. Then the prior claims were canceled and new claims 17 and 18 substituted therefor (CE pp. 319-320). By the amendment filed on June 11, 1957, the language of Claim 17 was changed to avoid the negative limitations (CE p. 325); and since new matter cannot be introduced in an application by means of amendment, it can be assumed that the amended claims did not in the view of the examiner introduce any new matter (CE p. 330).

I have reflected critically upon this evidence. I have skeptically questioned how the terminology "to such an extent as to avoid material agitation" is more positive than the phrase "without deep penetration." However, I would accept the uncontradicted testimony of the Primary Examiner, Mr. LeRoy, that "deep penetration" "was well known in the art" (PX-1002 p. 8). I also find that Suess et al. taught "a [67] localized penetration, and so the language that we finally adopted there was to bring out that feature." (PX-1002 p. 10). This the Primary Examiner evidently believed. Furthermore, in accordance with what the attorney for the applicants stated, these words expressed the differentiation of the "agitation" produced by the stirring action of the jet in Miles, from its lack of stirring in Suess.

All of this was evidently a matter of the negotiation of wording between the applicants and the Patent Office. But the concept of blowing as expressed in the specification and as it had been expressed in the many claims which had

previously been filed was not altered in substance. This was positive, undisputed evidence which came from former Patent Office representatives, those who negotiated with them, and patent law experts. It remains uncontradicted before me.

I also feel that the words "deep penetration" have been so overemphasized as to have acquired an unwarranted significance. In the constant reference by plaintiffs' counsel to the difference between the old art and the Suess patent, these words were used almost constantly, and even to such excess as, I can speculate, may have induced the *McLouth* District Court into [68] believing that the old Schwarz-Miles gist of invention was the deep penetration, whereas the gist of the Suess invention was the avoidance of deep penetration, and accordingly believing that this phraseology should have been included in the claims which ultimately were presented and allowed in the Patent Office.

Examiner LeRoy recognized this as an inappropriate, perhaps even an unnecessary, emphasis which the applicants had been making in contrasting the prior art from the instant patent when he said everyone knew that the prior art used deep penetration. (PX-1002 pp. 8, 9, 23). What LeRoy sought was to make those skilled in the art of steelmaking aware of a process creating a localized reaction zone at the surface of the bath. According to the thinking of this expert in the Patent Office, avoidance of deep penetration was not the "gist" of the invention; the localized reaction zone created under limited conditions at the surface of the bath was its essence. Accordingly he desired that the claims signify that there be no interference physically with the chemical action set up locally at the surface of the bath.

This novel concept was contained in the initial application, preserved in the continuation-in-part application, [69] and evolved as the consistent language in the final claims. It is accordingly obvious that throughout the course of this

patent prosecution from the time of filing of the original application on January 16, 1951, through the issuance of the patent on July 23, 1957, the recurrent theme appears of controlling bath ratio, oxygen pressure, and lance height to vertically create the hot spot in a localized zone of reaction in the central surface of the bath removed from the refractory walls, with the distinguishing cautionary phrases of avoiding deep penetration or material agitation by the oxygen stream, as those phrases might be understood by persons skilled in the art of steelmaking. Such practice protects the refractory, and invariably produces high quality steel.

As for the claims, although these do not seemingly mention the two phases of the chemistry described in the specification, that is the autogenetic and endothermic, it does generally describe the creating of the "localized reaction zone", as the words used therein explain that the oxygen is to be discharged in accordance with Claim 2 as projecting the words in Claim 1 "to an extent to avoid material agitation of the bath by the oxygen stream . . . resulting in reaction of the oxygen with a portion of the iron and with the oxidizable impurities . . . in a localized reaction zone. . ." and the circulation thereafter in the bath. To a person expert in the art of steelmaking, the words are such as to caution him to avoid the use of the oxygen stream so as not to disturb the localized reaction zone. Thus, in addition to the caution to avoid the stirring of the bath as done in prior art, there is the significance to the steelmaker that the discharge of oxygen must avoid any material agitation which would interefere with the creation and maintenance of autogenous (exothermic) localized reaction zone, so that the chemistry involved might function both autogenetically and endothermically.

I have already set forth in considerable detail here the file wrapper history and the wording of the claims as this wording evolved into a finalization between the Patent

Office and the patentees. But was this negotiation legally permissible so as to foreclose a file wrapper estoppel?

Generally, when one acquieses in the rejection of a claim and accordingly modifies it, he may not later expand his claim by interpretation to include principles originally rejected or their equivalents. *Schriber-Schroth Co.* v. *Cleveland Trust Co.,* [70] supra; *Trio Process Corporation* v. *L. Goldstein's Sons, Inc., supra; Ellipse Corp.* v. *Ford Motor Co.,* 452 F. 2d 163, C.A. 7, 1971. Stated differently, the doctrine of file wrapper estoppel results when a patentee who has acceded to rejection of his original claim *as lacking invention,* amends his claims to show a definitive characteristic distinguishing his device. He cannot then claim patentable novelty in any other disclosure of original patent or re-issue based upon it. *AMP Incorporated* v. *Burndy Corporation,* 332 F. 2d 236, C.A. 3, 1964., Cert.den. 379 U.S. 884 (1965).

However, the rule is not applicable where a patentee has not abandoned any element of his combination to meet any objections of the patent office examiner; *Toy Ideas, Inc. and American Character Doll Corp.* v. *Montgomery Ward & Co. Inc.,* 172 F.Supp. 878 (D.C.Md.,1959); or where the patentee encounters difficulty in the Patent Office because of particular wording and indefiniteness of the claims; *Eimco Corp.* v. *Peterson Filters & Engineering Co.* 406 F. 2d 431, C.A.10, 1968; Cert.den. 395 U.S. 963 (1969) or where an applicant for a patent does not surrender his broad claim in making the amendment of the application and the Patent Office does not make the amendment a condition of the grant; *Priebe & Sons Co.* v. *Hunt et al.,* 188 F. 2d 880, C. A. 8, 1951; or where the objections in the Patent Office do not result from prior art similarities. In *Toy Ideas, supra,* (at page 883) [71] where the examiner's objections to 11 claims were that they were "indefinite," new claims were filed to meet these objections, and file wrapper estoppel was held not to apply.

The evidence in the first hearing before me on file wrapper estoppel was that it is a normal procedure in the Patent Office for the examiners and the patent attorneys to negotiate on words of a claim. In this case the purpose of the discussion was to emphasize the *difference* between the instant patent and the prior art. There is considerable authority for such practice. *Eimco Corp.* v. *Peterson Filters & Engineering Co., et al., supra; Priebe & Sons Co.* v. *Hunt, supra; Bishman Manufacturing Co.* v. *Stewart-Warner Corp.*, 380 F. 2d 336, 339, C. A. 7, 1967, Cert. den. 389 U.S. 887 (1968); *L.S. Donaldson Company* v. *LaMaur, Inc.*, 299 F. 2d 412, C. A. 8, 1962.

It is important to note that the Patent Examiner, when he sought a positive rather than a negative assertion, was not concerned with any similarity between the instant patent application and the prior art, but rather with the difference of phraseology which described the theory from that of the prior art. Concerning similarity, Chief Judge Murrah in *Sears, Rosebuck Co.* v. *Jones*, 308 F. 2d 705, C. A. 10, 1962, Cert. den. 351 U.S. 972 (1951) at page 708 said:

> [72] "In these cases, however, the patentee limited his claim to a specific structural detail in view of the disclosures of prior art; argued and represented that the structural detail defined in his claims constituted the distinguishing feature of his patent over prior art; and issued his patent only with claims limited to such structural detail, thus acquiescing in the Patent Office rejections based on prior art disclosure. Jones' difficulty with the Patent Office did not result from any prior art similarities which had to be resolved by the limitation of his inventive claims to structural differences. Rather, Jones' attorneys had difficulty in wording claims acceptable to the Patent Office and the rejection of claims was based on 'indefiniteness.' The claims in suit solved Jones' problem of 'indefiniteness' and since Jones did not by representation or acquiescence, limit his patent to the specific structure of a release lever pivoted on the movable handle, we find no estoppel."

While in the *McLouth* case, as well as in these *J & L* cases, considerable emphasis was placed on the meaning of the words "deep penetration" and "material agitation", we are reminded what Judge Durfee said in *Autogiro Company of America* v. *United States*, 384 F. 2d 391 (Ct. Cl., 1967), at page 396:

> "The very nature of words would make a clear and unambiguous claim a rare occurrence. Writing on statutory interpretation, Justice Frankfurter commented on the inexactitute of words:
>
> > They are symbols of meaning. But unlike mathematical symbols, the phrasing of a document, especially a complicated enactment, seldom attains more than approximate precision. If individual words are inexact [73] symbols, with shifting variables, their configuration can hardly achieve invariant meaning or assured definiteness.
>
> Frankfurter, Some Reflections on the Reading of Statutes, 47 Col. L. Rev. 527, 528 (1947). See, also, A Re-Evaluation of the Use of Legislative History in the Federal Courts, 52 Col. L. Rev. 125 (1952)."

On April 29, 1970 at the first post-trial hearing the defendant raised an objection that this testimony was immaterial and that it violated the Parol Evidence Rule. I considered that even if the patent was a contract, the evidence here is merely explanatory of what occurred while the contract was being formulated.

The contractual nature of a patent is well documented in the federal judiciary, *Goodyear Dental Vulcanite Co.* v. *Davis* 102 U.S. 222 (1880); *Texas Co.* v. *Anderson-Prichard Refining Corp.*, 122 F.2d 829, C.A. 10, 1941. Recognition of this status had inevitably involved simultaneous acceptance of the well-known contract rule that patrol, or outside, evidence may be received to interpret the patent (or contract), but not to enlarge, diminish or vary the language, *Goodyear Dental Vulcanite Co.* v. *Davis, supra*, at page

227; *Van Der Horst Corp.* v. *Chromium Corp.*, 98 F. Supp. 412, 420 (S.D.N.Y. 1951).

Though I have also considered the possible conflict between Patent Office Rule 1.2 and my allowance of evidence concerning patentees' negotiations with the Patent Office examiners, and although they were not recorded verbatim in the file wrapper, the negotiations were referred to there (PX2A, at page 74). As was stated in *Lavell Aircraft Corp.* v. *United States*, 358 F.2d 1005, 1007-1008 (Ct.Cl. 1966): "For purposes of determining whether or not an accused structure infringes a claim, the claim *must* be interpreted not only in light of the specification but *also with reference to the statements made to secure the allowance of patent claims.*" (citing cases) (Emphasis added).

Avoidance of Deep Penetration Within the Specifications

I have reviewed the various references by the *McLouth* District Court related to patent terminology and particularly to reasons why it seemed to strike upon a finding that "avoidance of deep penetration was the *gist* of the invention." This is extremely critical because this conclusion was adopted by the Court of Appeals. However, consideration of its meaning must be from the viewpoint of both the experts skilled in the art of steelmaking and of a lawyer or judge called upon to give it meaning or significance.

From the very beginning I had the conviction the *McLouth* District Court's statement meant that "avoidance of deep penetration" was the *sine qua non* of the invention. Assuming then that "avoidance of deep penetration is the invention," it would seem sufficient for anyone skilled in the art of steelmaking to be able to make steel of open-hearth quality without any further instructions.

[74] Throughout the *McLouth* record the District Court's conclusion, that the concept of "avoidance of deep penetration is the gist of the invention," places emphasis on

this one aspect which as the District Court said, was recited four times in the patent specification.

It is obvious here that if the specification had attempted to teach one skilled in the art of steelmaking only "avoidance of deep penetration" without any other instructions, it would have taught him no process at all. Why would the patent have prescribed detailed instructions on character of vessel, size of nozzle, pressure and height of nozzle, vertical and central placement of nozzle, and ratio of bath depth to surface area and the reasons therefor, if "avoidance of deep penetration" was the invention?

We observe that throughout the entire prosecution, as reflected in the file wrapper history, the specification remains virtually undisturbed and unchanged. Even in the claims, which went through a refinement process, "avoidance of deep penetration" had been referred to as an afterthought. In other words, both the specification and the claims *ab initio* gave the impression that deep penetration was an unwanted circumstance; and it was evidently this caution which the principal examiner sought to [75] have the applicants reflect in more positive language. The testimony of LeRoy and Gardner was supported by the file wrapper history where in the remarks appended to the June 17th amendment it is stated that Claim 17 (which became the approved Claim 1) "is made in view of the conference with the Primary Examiner on June 14, 1957 in order to improve the definiteness of the claim and to eliminate the negative limitation present therein." (PX2A, p. 98).

Depth of penetration is a function of nozzle pressure and nozzle height from the bath. The District Court was impressed by these two factors as they were shown by the experimentation of Suess on June 25, 1949. Control of nozzle pressure and nozzle height, however, are just two facets of the many overall instructions of the Suess patent. If we were concerned with these two phases, and these alone,

"deep penetration" or "avoidance of deep penetration", would be the subject matter and required to be stated in the claims. But since the patent teaches pressures, capacious contents, vertical or approximately vertical, central nozzle placement and ratio of depth to surface area—these also become vital factors; and while they all bear a definite contributing combination-relationship to "avoidance [76] of deep penetration", these additional factors are so essential in other respects as to make the process impossible without the attainment of all of them.

For example, if the nozzle is placed at various angles such as permitted by Schwarz, Miles, Durrer and Hellbruegge, then in actuality there would not be practical oxygen impingement on the bath surface. The oxygen jet would strike angularly at part of the bath and produce refractory harm to the opposite side. If the nozzle were placed off center so that it was closer to the one refractory wall, it would destroy that refractory. If there was a disregard of ratio of depth to surface area, a shallow bath or a too narrow surface would provide unwanted intimacy between the oxygen and bottom or side wall refractory.

As one reads the entire phraseology of the specification, specifically the four places where references are made of "avoidance of deep penetration", with their accompanying and surrounding language, one recognizes that the conclusions of the District Court did not reflect the thinking and teaching of the patentees. Accordingly, I set forth the particular phraseology of the four references in their context as they appear in [77] various places of the specification:

(1) "According to the process of the invention, the high purity oxygen jet is blown vertically, or approximately vertically, upon the central portion of the surface of a bath of the molten metal, the jet having a diameter and static pressure at the point of origin, that is, at the blast nozzle or other jet producing means, and the point of origin (blast nozzle being spaced from the bath surface, such

that direct contact of the oxygen jet and the molten metal *is established and maintained* throughout the refining period *without deep penetration of the molten metal bath by the jet.*" (Emphasis added). (Col. 3, 36-47).

(2) ". . . produces a sufficiently high reaction velocity of the oxygen with the bath constituents to insure the development of autogenous heat at a rate sufficient to provide the heat required for completion of the refining in a minimum of time, consistent with controlled temperature and control and development of other necessary and required process conditions, such as fluid slag, *avoidance of over-oxidation* (undue loss of iron to the slag), and *avoidance of slopping. The process conducted under these conditions avoids a deep penetration of the oxygen gas into the molten bath. . .*" (Emphasis added). (Col. 3, lines 64-75).

(3) "The ensuing reaction of carbon with the FeO and directly with the oxygen gas in the confined direct oxidation zone causes rapid formation of carbon monoxide and the formation of this CO causes a strong boil or agitation of the bath, which augments the bath circulation to continuously present unrefined metal to the oxygen gas reaction zone and to create a slag-metal emulsion. The oxygen jet thus contacts the emulsion of bath [78] and slag components which presents a larger reaction surface and causes the refining reactions to progress rapidly *although the oxygen jet does not penetrate deeply into the molten metal bath and is confined to an impingement area at the central portion of the bath surface.*" (Emphasis added). (Col. 4, lines 60-72).

(4) "In general, it may be stated, that as the oxygen pressure and nozzle diameter are increased, the nozzle spacing is also increased, for example, as the capacity of the refining vessel and total charge is increased. *Under these conditions, deep penetration of the molten metal bath is avoided,* while the necessary displacement of the slag cover to maintain direct oxygen to molten metal contact is insured." (Emphasis added). (Col. 9, lines 13-20).

As is obvious, these four references in the specification, as cited for authority by the *McLouth* District Court that "avoidance of deep penetration is the gist of the invention" do not so state. Nor is such a statement contained elsewhere in the specification. Therefore, it is clear that *the specification* does not make "avoidance of deep penetration the gist of the invention."

The statement that the specification does not express any authority on which a finding may be made that avoidance of deep penetration is the gist of the invention is intended only for the limited consideration of the question of file wrapper [79] estoppel.

I have inquired into the complete file wrapper history in the Patent Office and ascertained why the phraseology of blowing the oxygen stream "to such an extent as to avoid material agitation of the bath" was agreed upon between the primary examiner and the applicants as a substitute for the phraseology "avoidance of deep penetration", and have further considered the law relating to such negotiations. Secondly, I have heretofore examined the specification and its instructions and have arrived at the conclusion that the Suess patent instructs the oxygen to metal contact impingement in such manner that the agitation or stirring of the bath, as in the case of prior art, is avoided; and further, that the language contained in the claim is inclusive of these circumstances. Thus these claims, obtained from the specification itself, add further corroboration to the prima facie status of the patent validity. The foregoing observations lead me to a third avenue of inquiry raised by the plaintiffs under *Blonder-Tongue.*

The plaintiffs assert that they were deprived without any fault of their own of the opportunity to be heard on the issue of file wrapper estoppel as determined by the *McLouth* District [80] Court. This is believable in view of the fact that the defendant did not raise this point as an issue in its pleadings or during the trial of the case. In

all fairness I should perhaps give the plaintiffs the benefit of the doubt despite their failure, knowingly or unknowingly, to act under the circumstances, since under the then prevailing law of *Triplett,* their failure to act on any or all phases of their case did not estop them from raising the point as a new action.

As a matter of equity, due process requires notice and an opportunity to be heard before a person may be deprived of any fundamental rights. That principle has been too well recited in recent times to require authority. That does not mean that a judge does not have the power to raise and decide matters *sua sponte;* it is only to say that when done *sua sponte,* a judge should accord the affected parties some fair notice and the opportunity to be heard on the matter before making any determination. In *Blonder-Tongue* for instance, the Supreme Court exemplified the practice. At page 317 (402 U.S.), it said:

> "We granted certiorari 400 U.S. 864 (1970), and subsequently requested the parties to discuss the following additional issues not raised in the petition for review:
>
> [81] '1. Should the holding of *Triplett* v. *Lowell,* 297 U.S. 638, that a determination of patent invalidity is not res judicata as against the patentee in subsequent litigation against a different defendant, be adhered to?
>
> '2. If not, does the determination of invalidity in the *Winegard* litigation bind the respondents in this case?' "

Our Federal Rules of Procedure further exemplify our belief that a person must have notice and the right to be heard before he may be lawfully burdened by a court of law. For these various reasons and as a matter of equity I am persuaded not to permit foreclosing the rights of the plaintiffs by virtue of the doctrine of this element of collateral estoppel. Though this would have been so before *Blonder-Tongue,* the added estoppel limitations set forth

there make the *sua sponte* decision in the *McLouth* District Court seem more crucial. On the question then of file wrapper estoppel, I hold that the plaintiffs in *McLouth* were deprived, without fault of their own, of a fair opportunity to present evidence on the issue of file wrapper estoppel. Having been granted the opportunity here, the plaintiffs have shown by substantial evidence that there was no abandonment of the Suess et al. practice of avoiding deep penetration and that the defendant in the instant case is not [82] entitled to the defense of the doctrine of file wrapper estoppel here. Further, from this evidence, I find that to one skilled in the art of steelmaking, the concept of avoiding deep penetration is identical to the concept of avoiding material agitation.

[83]

III. Collateral Estoppel—Summary of McLouth Opinions

If there is any authority for me to act here, it must be by virtue of the limited exceptions expressed or reasonably inferred from the *Blonder-Tongue* mandate. It is clear, however, that a district court in subsequent determinations of patent validity must permit proof in certain areas and thereafter make findings thereon:

> "But as so often is the case, no one set of facts, no one collection of words or phrases, will provide an automatic formula for proper rulings on estoppel pleas." (402 U.S. at pages 333-334).

We keep in mind that

> ". . . once the defendant in support of his plea identifies the issue in suit as the identical question finally decided against the patentee or one of his privies in the previous litigation . . ., the patentee-plaintiff must be permitted to demonstrate, if he can, that he did not have 'a fair opportunity procedurally, substantively and evidentially to pursue his claim the first time.'" (402 U.S. at page 333).

We keep in mind, also, that the burden of proof in an estoppel is upon the patentee-plaintiff. Based then on their allegations and the evidence presented at both post-trial hearings before me, I conclude that my entry into the inquiry must be by way of "the opinions filed by the District Court and the reviewing court . . ." (402 U.S. at page 333) in an effort to determine [84] whether or not a fundamental lack of understanding occurred. Therefore, a short summary of the relevant opinions is appropriate.

The McLouth District Court determined that the patentees were the inventors of a process which was neither anticipated by the prior art, nor obvious to one skilled in the art of steelmaking. However, the patent was held invalid for the reason that the specification did not support the claims, and the claims did not measure the invention as required by 35 U.S.C. §112.

Specifically, the District Court found that, "Since the avoidance of deep penetration is clearly an indispensable step and indeed the very gist of the invention, its omission from the claims of the patent in suit renders the claims invalid and the patent in suit must, therefore, be held invalid for this reason alone." (257 F. Supp. at page 428).

The District Court reasoned that ". . . when the applicants were faced with the rejection of claims accurately stating what they regarded to be their invention as unpatentable over the prior art, they unwisely abandoned such claims and instead substituted new claims which were accepted by the Patent Office. The new claims failed to point out the actual invention of the [85] patentees, and, in addition, certain portions of the claims were not given adequate or meaningful support by the specification." (257 F.Supp. at page 440).

And ultimately, the District Court concluded that "the claims of the patent in suit do not measure the invention of the applicants; they do not accurately define or correctly describe just what the applicants invented; they do not find

adequate support in the specification; and they do not clearly distinguish what is claimed from what went before in the prior art. Therefore, the claims do not meet the requirements of 35 U.S.C. §112, and the patent in suit must be held invalid. 35 U.S.C. §282(3)." (257 F.Supp. at page 441).

The District Court "reluctantly" reached this conclusion because of its earnest belief that the invention disclosed was revolutionary in nature. Nevertheless, ". . . the failure of the claims to focus on or limit themselves to the precise advance in the art by the patentees renders the patent invalid." (257 F.Supp. at page 442). This precise advance, as determined by the District Court, was "the avoidance of deep penetration by the oxygen jet."

The *McLouth* Court of Appeals determined that the claims overclaim the invention and the claims cover the prior art. The [86] Appeals Court found that having limited the concept of "avoidance of deep penetration" to practically negligible penetration during the patent prosecution, the patentees could not attempt to incorporate broader limitations. (400 F.2d at page 49).

Additionally, the Court of Appeals held that the patentees had failed to distinguish their depth of penetration from the prior art. Because the Appeals Court believed that the only difference between the Suess process and the prior art arose from an "alleged" differentiation in degree of penetration, this failure was held to be fatal. Specifically, the Appeals Court found that ". . . the patentees failed to define their alleged advance over the prior art and that in failing to properly limit their claims they attempted to extend their monopoly to something already patented. For either reason, or for both reasons, the patent must be held invalid." (400 F.2d at page 51).

Parenthetically, it should be observed a majority of the Court of Appeals held the doctrine of file wrapper estoppel applicable.

These resumes reflect the primary findings contained in the Opinions of the District Court and of the Court of Appeals, with which the plaintiffs find fault.

[87]

IV. Avoidance of Deep Penetration—Claimed or Not

The first inquiry into the *McLouth* findings concerns the conclusion that "avoidance of deep penetration is the gist of the invention" of the Suess patent, and that as a concept it was abandoned in the Patent Office by the acceptance in its place of the phraseology "avoidance of material agitation", which allegedly had no supports in the specification.

The District Court Opinion states that after the litigation had been settled in Austria and Germany over the ownership of the patent rights for the Linz process, a continuation-in-part application was filed in the United States on November 16, 1955, with a more detailed specification and new claims "the first four of which were *directed* to the avoidance of deep penetration of the bath by the oxygen stream as the gist of the invention (PX2A). All the new claims were rejected by the Patent Office on June 14, 1956 as unpatentable over prior art." (257 F. Supp. at page 372, 380-81). (Emphasis added). On December 7, 1956, the first 10 claims were canceled, and the remaining five claims were resubmitted along with a new one. The pending six claims were canceled by the applicants "without waiting for Patent Office action, and two new claims were submitted . . . The patent was issued July 23, 1957." (257 F. Supp. at page 381).

Even as the original 1951 application contained no [88] specific instructions for the avoidance of deep penetration, so, too, the claims submitted under the continuation-in-part application contained no specific words instructing the operator to "avoid deep penetration". They, however, contained other instructional factors for making the process

work: (as in the case of the first claim under the continuation-in-part application) "*while* avoiding deep penetration of the molten metal bath by the jet"; and (in the second claim) "*while* avoiding deep penetration of the molten metal by the jet, and controlling the area of impingement such that a relatively confined zone of direct oxygen-molten metal contact is established and maintained" at the bath surface; and (in the third claim) "*under such conditions* that deep penetration of the molten metal by the jet is avoided, and a relatively refined zone of direct oxygen-molten metal contact is established and maintained;" and (in the fourth claim) "*without* deep penetration of the bath by the jet." [15]

[89] If, in fact, the applicants had pointed out and distinctly claimed "avoidance of deep penetration" as the subject matter which they regarded as their invention, such a fact would have undoubtedly appeared in the claims. (*Application of Borkowski*, 422 F. 2d 904, 909, C.C.P.A., 1970). Clearly this was the thinking of both the District Court and the Court of Appeals.

Analyzing the original four claims of the continuation-in-part application, we observe that variations of the phraseology "avoidance or avoiding deep penetration" appears in all these claims. However, this language did not appear in isolation, but rather in combination with other highly relevant criteria. For instance, claim 1 contained

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[15] The continuation-in-part application specification (PX-2A) which remained unchanged throughout on this phase of the case contains this phraseology:

Column 3, lines 45-46 "without deep penetration of the molten metal bath by the jet."

Column 3, lines 73-74 ". . . under these conditions avoids a deep penetration . . ."

Column 4, lines 70-71 "although the oxygen jet does not penetrate deeply into the molten metal bath . . ."

Column 9, lines 17-18 "Under these conditions, deep penetration of the molten metal bath is avoided . . ."

reference to (1) jet diameter, (2) static jet pressure, (3) vertical placement of the jet, (4) central placement of the jet, and (5) surface placement of the jet, so that (6) the relatively confined zone of oxygen to molten metal with respect to the total bath surface area is established and maintained while avoiding deep penetration of the molten metal bath by the jet.

The second claim contained these elements: (1) jet diameter, (2) static pressure, (3) vertical blowing, (4) surface blowing, (5) central blowing, (6) slag layer initial displacement so as to establish (7) direct contact of the oxygen jet with the molten metal, while (8) avoiding deep penetration of the molten metal by the jet, and (9) control of the area of impingement, such that a relatively confined zone of direct oxygen molten metal [90] contact is (10) established and maintained at the bath surface area.

The third claim contained these features: (1) jet impingement on the bath surface under such conditions that deep penetration of the molten metal by the jet is avoided, and (2) a relatively confined zone of direct molten metal contact is established and maintained.

The fourth claim included the following features: (1) vertical blowing of the oxygen jet (2) onto the surface of the bath (3) at the central portion, and (4) to establish and maintain a relatively confined zone of direct oxygen metal contact without deep penetration of the bath by the jet.

In an application for a patent for a process it has been held that "the steps comprising the process are the essential features for consideration in determining the right of appellants to a patent": *Application of Magat,* 240 F. 2d 351, 353, (C.C.P.A. 1957;) *In re Swain,* 154 F. 2d 118 (C.C.P.A. 1946.) While these four claims incorporated the references to nozzle jet placement, there was no specific claim by any of them of avoidance of deep penetration, as

the subject matter which the applicants regarded as their invention (§112). "Avoidance of deep penetration" was not featured in any of the four claims as were the other common factors, that is (1) vertical blowing, [91] (2) central jet blowing, (3) surface jet blowing, (4) establishment and maintenance of oxygen to metal contact, and the other factors.

If, as is now obvious, avoidance of deep penetration was not pointed out and claimed as a factor in the subject matter which the applicants claimed as their invention, it could not, in reality, be said that even if their wording was varied that they would have been abandoned as "factors" of the subject matter iself. Thus, if "avoidance of deep penetration" was the subject matter i.e., the gist of the invention, which the applicants regarded as their invention, one would have expected that the applicants would have set it out specifically and separately as such in the claims. Furthermore, it would have been set out specifically and separately and fully in the specification. Apparently, the common features hereinbefore enumerated as they were contained in all four claims, comprised the subject matter since they were "particularly [pointed out] and distinctly [claimed]" as such and as required by law. Thus "avoidance of deep penetration" was something else. And since it is invariably prefaced in the specification by such modific- [92] ations as "while", "under such conditions", "without" and "although", it is apparent that "avoidance of deep penetration" was a subsequent and intermediate result. Accordingly, if "avoidance of deep penetration" occurs as a result of practicing the teachings contained in the specification as they are delineated, pointed out, and claimed as the subject matter of the invention, it exists by virtue of the inventive features and resultantly because of them. That is, as far as instructions go, it is mere surplusage. It cannot be said that one resulting circumstance was, or could be, the subject matter, or the gist, or the heart of the invention.

The law requires only that claims state the subject matter of the patent and not how the patent is to be accomplished. *Bocciarelli* v. *Huffman*, 232 F. 2d 647, 651, C.C.P.A., 1956. Thus, the word "while" as it was used in the first and second claim, and the words "under such conditions" as used in the third claim, and the word "without" as used in the fourth claim were neither words of subject matter or instructions. They were explanatory or illustrative of intermediate results for making those skilled in the art of steelmaking aware of what to look for in the performance of the process. *Cummins Engine Co.* [93] v. *General Motors Corp.*, 299 F.Supp. 59, 90 (D.C. Md. 1969) Aff. 424 F. 2d 1368, C. A. 4 1970.

Process patents bear considerable similarity to combination patents as each relates to the component steps constituting the method.

Thus, even if the claims had been allowed as originally drawn, they could not have indicated that avoidance of deep penetration was the gist of the invention. As was pointed out in *Joseph Schmidinger and Tung-Sol Electric, Inc.* v. *Welsh*, 383 F. 2d 455, 459-460, C. A. 3, 1967;

> "We desire to make it clear that we are aware that the validity of claims of a combination patent cannot rest on any 'essential' element 'gist' or 'heart' asserted to lie in the invention."

This was based on authority from the Supreme Court in *Aro Manufacturing Co.* v. *Convertible Top Replacement Co.* 365 U.S. 366 (1961). In *Aro* a convertible folding top for automobile bodies was involved in the patent, and the patentee claimed that the patent covered the replacement of worn out fabric of the device. The opinion as delivered by Mr. Justice Whittaker asserts that:

[94] "Respondent has strenuously urged, as an additional relevant factor, the 'essentialness' of the fabric element to the combination constituting the invention. It argues

> that the particular shape of the fabric was the advance in the art — the very 'heart' of the invention — which brought the combination up to the inventive level, and, therefore, concludes that its patent should be held to grant it a monopoly on the fabric." (365 U.S. at page 344).

The Court continues:

> "We cannot agree. For anything is settled in the patent law, it is that the combination patent covers only the totality of the elements in the claim and that no element, separately viewed, is within the grant. See the Mercoid cases, supra, 320 U.S. at 667; 320 U.S. at 684. The basic fallacy in respondent's position is that it requires the ascribing to one element of the patented combination the status of patented invention in itself." (365 U.S. at pages 344-345)

In *Mercoid Corporation* v. *Minneapolis-Honeywell Regulator Co.*, 1944, 320 U.S. 680 to which Mr. Justice Whittaker made reference, the questions involved an unpatented device which was embraced in the furnace assemblies ". . . which neither the patentee nor the licensee makes or vends," (320 U.S. at page 666), and for which evidently a patent extension right was later claimed. Mr. Justice Douglas who delivered the opinion there, said:

> "That result may not be obviated in the present case by calling the combustion stoker switch the 'heart of the invention' or the 'advance in the art.' The patent is for a combination only. [95] Since none of the separate elements of the combination is claimed as the invention, none of them when dealt with separately is protected by the patent monopoly. *Leeds & Catlin Co.* v. *Victor Talking Machine Co.* (No. 1), 213 U.S. 301, 318." (320 U.S. at page 667).

As related to the instant matter, an examination of the Suess patent as it was granted contains no reference either expressly or by implication that "avoidance of deep penetration" is either the "gist" or the "heart" of the inven-

tion. The separate claims of the patent so granted distinctly enumerated the various factors as they had been more or less included in the first four claims originally filed, some of which were contained in the first 12 claims. The combination of all of the elements going into and forming the subject matter as pointed out and distinctly claimed by the applicants was their invention. And the specifications with all of its explanation of prior art, failures, present objectives, process content, instructions for accomplishing the process objectives and examples or modes for performance of the variables of the patent process stress no separate elements of the process, but the combination elements or factors as necessary requisites for one skilled in the art of steelmaking to successfully perform the process.

[96] The *McLouth* District Court refers to the original 1951 application by Suess in the United States Patent Office to the effect that it was "claiming the gist of the invention to be the maintenance of a certain proper ratio between the bath depth and surface area". (257 F.Supp. at page 399) It is emphasized that Dr. Suess in the subsequent continuation-in-part application claimed "avoidance of deep penetration in the bath by the oxygen as the essence of the invention." (257 F.Supp. at page 399). Dr. Rinesch's affidavit on the June 1949 tests said " 'that a satisfactory refining, operation could be obtained so long as the oxygen jet does not penetrate deeply into the bath.' (DX-116, p. 4).[16] The Hauttmann affidavit considered the invention to be the creation of a limited center of reaction 'substantially in the surface layer' resulting in a controlled circulation of the bath. (DX-117, pp. 3-4."[17] (257 F. Supp. at pages 399-400). "Dr. Hauttmann also expressed his opinion that the limited center of reaction and circulation was brought about by the avoidance of deep penetration (DX-117 pp. 4-5)" (257 F.Supp. at page 400) "Dr. Trenkler the other

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[16 and 17] DX-116 and DX-117 from McLouth record are PX-2-A in the J & L record.

[97] patentee, testified that the only significant difference in practice over prior teachings was a reduction of the *impact pressure* of the jet and, therefore, a lesser penetration into the bath by the jet than would have resulted from prior teachings. (R. 11,905) [18] Thus, at one time or another, all four of the patentees expressed their understanding that the avoidance of deep penetration was the basis of a successful oxygen steelmaking process." (257 F.Supp. at page 400) [19] (Emphasis added).

Despite all of its discussions concerning the avoidance of deep penetration and lessening of impact being the gist of the invention, the *McLouth* District Court Opinion never states that the Suess et al. process also consists of additional factors. Rather we are led to the inference that avoidance of deep [98] penetration or lessening of impact pressure is the sole ingredient of the patent process and holds the exclusive claim of total invention.

Yet, lessening of impact pressure is a mere physical or mechanical operation, and one which common sense belief would indicate any person skilled in the art of steelmaking (such as Schwarz, Miles, Durrer or Hellbrugge) could have easily made as a simple adjustment. Dr. Durrer himself acknowledged the momentous accomplishment, when he said, "I had not expected you to be able to solve this problem so quickly, and am therefore all the more delighted, now that I have been able to see the beautiful results with my own eyes. Now that the problem has been solved in principle, . . ." (DX-251-E)

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[18] R. 11,905 from McLouth transcript is PX-J-35 p. 11,905 in J & L record.

[19] A distinction must be made here of what these applicants stated regarding the difference between the successful and unsuccessful tests on June 25, 1949, as contrasted with the unsuccessful venture of Durrer and Hellbruegge and of the prior art, not of the difference between the patent specification and the prior art.

[99] **V. Physical-Mechanical-Chemical**

The plaintiffs contend that the *McLouth* District Court's conclusion, that the specification does not support the words of the claim that a circulatory movement in the molten metal bath is chemically induced, is factually insupportable. Specifically they attack the District Court's conclusion that "The claim of a circulatory movement in the molten metal bath produced by chemical reactions in a localized reaction zone is simply not supported by the teachings of the specification of the patent in suit." (257 F.Supp. at page 436).

This conclusion was based on a determination that, ". . . plaintiffs are forced to engage in tortured construction of the specification and claims in the patent in suit in order to find support in the specification for a claim of reaction-induced circulation." (257 F.Supp. at page 438) The *McLouth* District Court found that the oxygen jet mechanically causes bath circulation. If this conclusion is valid its support must lie only in the Suess et al. patent specification

I have exhaustively searched the patent specification for supports for these findings in the Opinion and have been unable to do so. I have come to the conclusion that the only possible [100] support upon which any possible base may be laid lies in the words "brings about a flow in the molten metal" (col. 4, lines 30-31), when the patentees stated that "It is believed that application of the oxygen jet substantially vertically or approximately vertically upon the central portion of the bath surface brings about a flow in the molten metal from the center of the surface of the bath downwardly" (col. 4, lines 27-32). Here it will be seen that the patentees have merely expressed a theory of what they believe happens on the inside of the activated furnace, and from the chemical explanation as it is a little later presented that the result "brings about a flow" which occurs after the "application" is made of the oxygen jet "upon the central portion of the bath surface". (col. 4, lines 26-

30) In order to comprehend this it is advantageous to understand the preliminary statements made in the patent.

In examining the objections to the prior art set out in this patent (col. 1, lines 37-73; col. 2, lines 1-35), vis-a-vis the patent's object (col. 2, lines 36-73, col. 3, lines 1-12), we see a two-fold process: First, that which the steelmaker is required to do, i.e., the mechanical performance; and second, the resultant behavior of the metal bath after the steelmaker [101] has performed his instructed functions, i.e., the chemical performance.

The requirements for the operator's physical performance are specifically set forth:

According to the process of the invention, the high purity oxygen jet is blown vertically, or approximately vertically upon the central portion of the surface of a bath of molten metal . . . the jet having a diameter at the point of origin or blast nozzle of about 1 millimeter (1/25 inch) per ton of charge, having a relatively low static pressure of from 5 to 25 atmospheres (about 75 to 375 pounds per square inch), preferably at about 8 to 12 atmospheres (about 115-175 pounds per square inch), with a blast nozzle spaced from the bath surface from at least 150 millimeters (about 6 inches) up to about 2000 millimeters (about 80 inches), spacing is such that direct contact of the oxygen jet and the molten metal is established and maintained throughout the refining period. (col. 3, lines 36-64)

These teachings involve purely physical activity on the part of the steelmaker. Thus, even the act of causing the oxygen jet to impinge upon the surface of the bath is includable [102] in the physical or mechanical instructions to the operator.

The steelmaker is told that in so operating, the area of jet impingement is controlled (physically) to produce a relatively confined zone of direct oxygen to molten metal contact with respect to the total surface area of the bath,

and this (now chemically) produces a sufficiently high reaction velocity of oxygen and bath constituents to insure development of autogenous heat sufficient for the completion of the refining process in a minimum of time, consistent with controlled temperature and control and development of necessary process conditions such as (1) fluid slag, (2) avoidance of overoxidation (undue loss of iron to slag), (3) avoidance of stopping, (4) avoidance of impairment of the refractory bottom, and (5) isolation of the refractory walls to prevent injury to them. (col. 3, lines 47, 63-75, col. 4, lines 1-5)

The operator is further instructed to maintain a ratio of depth of bath to surface area from about 1 to 5 to about 1 to 28, or in terms of the ratio depth to diameter of the circular bath between 1:2.5 and 1:19.[20] The reason for this [103] ratio of depth of bath to surface area of the bath is that it "augments the protection afforded to the refractory lining of the refining vessel and is also beneficial to the progress of the refining reactions to produce finished steels of low impurity content comparable to those produced by the basic open hearth process." (col. 4, lines 7-25)

Commencing with col. 3, line 64 to col. 4, line 6, we learn of the results produced from the instructed physical actions of the steelmaker. While these results are initiated by the physical or mechanical acts of the steelmaker, they are in themselves no longer physical but rather chemical.

Although it is the steelmaker who physically places or puts together the various components such as the molten iron and oxygen, it is a natural phenomenon which produces the sufficiently high reaction velocity caused by the oxygen combining with the bath constituents so as to de-

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[20] These figures are taken directly from col. 4, lines 15-25 of the specification. However, Dr. Elliott testified (PX-J-19 p. 6103) ". . . that is an arithmetic error with regard to 1:19. It should be 1:6."

velop autogenous heat sufficient to provide the completion of the refining process. (col. 3, lines 16-27)

It is not the physical or mechanical pressure of the oxygen jet which causes the autogenous heat, but rather the combination of oxygen with the oxidizable impurity contained in [104] the bath. And it is this heat that causes the completion of the refining process. (col. 3, lines 64-73)

The specification clearly discusses the chemical consequence of the jet's impingement on the molten bath surface:

> "Due to the very high affinity of oxygen for iron, initial contact of the high purity oxygen jet with the molten metal bath causes a rapid combination of oxygen and iron to form FeO in the confined central reaction zone. This is demonstrated by ignition of the oxygen and the propagation of a visible flame within the first minute of blowing. This reaction, together with oxidation of impurity elements, such as silicon and manganese, develops extremely high temperatures in the zone of direct oxygen contact with the molten metal which approach the boiling point of iron, as demonstrated by the evolution of a fume containing iron oxide and manganese oxide. A portion of the iron oxide goes to the slag with the other oxidized elements and a portion diffuses into the bath under the influence of the bath circulation, so that within the first three minutes of the blowing vigorous carbon combustion is initiated due to the high temperatures developed by these reactions. The ensuing reaction of carbon with the FeO and directly with the oxygen gas in the confined direct oxidation zone causes rapid formation of carbon monoxide and the formation of this CO causes a strong boil or agitation of the bath, which augments the bath circulation to continuously present unrefined metal to the oxygen gas reaction zone and to create a slag-metal emulsion. The oxygen jet thus contacts the emulsion of bath and slag components which presents a larger reaction surface and causes the refining reactions to progress rapidly although the oxygen jet does not penetrate deeply into the molten metal bath and is confined to an impingement area at the central portion

> of the bath surface. This vigorous boiling action is opposed by the pressure of the oxygen jet only in the area of impingement . . .'' (col. 4, lines 43-74)

[105] The action thus described is purely chemical, commencing from the initial contact of the high purity oxygen jet with the iron contained in the molten metal bath to the completion of the refinement.

Jean Bogert states in his book *Fundamentals of Chemistry* W. B. Saunders Co. (Phila) Seventh Edition, 1953, at pages 138-139:

> ''Only a few substances have such a great 'chemical affinity for each other that they will unite spontaneously, as iron reacts spontaneously with the oxygen and moisture in the air to form rust . . .', and chemical affinity or activity depends upon the atomic structure of the elements . . . And where such chemical affinity exists, reaction between them may be accelerated by the application of heat and after that the heat generated keeps it going.''

In the determination of invention and patentability it is of no concern to a court that an inventor does not know or cannot prove the scientific basis or reason for the working of the invention, since he is not legally required to comprehend the scientific principles on which the practical effectiveness of his invention rests. *Application of Aufhauser*, 399 F.2d 275, C.C.P.A. 1968. The law is concerned only with the fact that the patent works. *Eames* v. *Andrews*, 122 U.S. 40, 55-56 (1886). As Mr. Justice Matthews, speaking for the Court in *Eames* said **[106]** (at pages 55-56):

> ''It is to be observed that the scientific theory and principle, the application of which is supposed to constitute the invention of Colonel Green, are not set forth either in the original or re-issued patents. This feature was commented upon by Mr. Justice Blatchford in *Andrews* v. *Cross*, 19 Blatchford, 294, 305, as follows: 'It may be that the inventor did not know what the scientific principle was, or that knowing it, he omitted,

> from accident or design, to set it forth. That does not vitiate the patent. He sets forth the process or mode of operation which ends in the result, and the means for working out the process or mode of operation. The principle referred to is only the why and the wherefore. That is not required to be set forth . . . [T]he specification contains a description of the invention and of "the maner and process of making, constructing, compounding, and using it," in such terms as to enable any person skilled in the art to which it appertains to make, construct, compound, and use it; and, even regarding the case as one of a machine, the specification explains the principle of the machine, within the meaning of that section . . . An inventor may be ignorant of the scientific principle, or he may think he knows it and yet be uncertain, or he may be confident as to what it is, and others may think differently. All this is immaterial, if by the specification the thing to be done is so set forth that it can be reproduced.' "

Thus, whether or not the chemistry was understood would be "immaterial, if by the specification the thing to be done is so set forth that it can be reproduced." That it could be done, that it was a "revolutionary" invention adopted by the steelmakers the world over, that it produced beter steel than any which had [107] theretofore been produced by the prior art, equal to or better than quality of the open-hearth furnace, that it preserved the refractory linings, and that it necessitated a bare fraction of time required for the open-hearth process is all factually found in both *McLouth* Opinions. Thus, although I would ordinarily not need to examine the scientific principles or truths involved in this Suess et al. process, I am here compelled to do so in order to ascertain whether any misconception of those scientific principles or mis-interpretation of the wording of the specification as it may set forth those scientific principles is discernable in the prior opinions and brought about a final determination which worked an injustice without fault on the part of the plaintiffs.

From reading the detailed description of the chemical action contained in the specification, and from observing the effects produced in cyclical fashion once the oxygen jet impinges on the metal bath surface and makes contact with the iron, silicon, manganese and other impurities, it is impossible to separate the chemical effects from the physical impingement of the oxygen jet itself.[21] Nevertheless, to make a declaration [108] that the specification asserts that it is the physical action of the jet which produces the refining action in the molten metal, cannot be reconcilable with the meticulous wording of the specification relating to the chemistry involved.

In the internal combustion engine, a series of electric sparks are arranged alternately to ignite air (oxygen) enriched mixtures of fuel and cause explosions which in turn result in cams moving and with these the wheels of a vehicle. Would it then be logical to say that it was the sparkplugs' ignition which caused the wheels to move without giving the necessary intermediate credits? Where a dynamite blast is set off by an electric spark initiated by a plunger hundreds of yards away, is it logical to say that the plunger causes the chemical explosion rather than the ignition? Yet, in analogous fashion that seems to be the conclusion of the *McLouth* District Court regarding circulation. All of the chemical results are due to the physical impact of the jet as it contacts the metal impurities, yet at some point the physical and the chemical reaction may be separated (or joined). This, the *McLouth* District and Appellate Courts failed to do.

While the *McLouth* District Court relied upon the references [109] contained in col. 4, lines 26-38, and col. 4, lines 63-67, it is singular that no reference was made to col. 3 where instructions are given for the physical action of the steelmaker required to "produce a sufficiently high reaction

[21] We shall learn more of these respective forces and their relationship to each other later.

velocity of the oxygen with the bath constituents to insure the development of autogenous heat. . .'' (col. 3, lines 64-73). It is this action which initiates the chemical action: ''Due to the very high affinity of oxygen for iron, initial contact of the high purity oxygen jet with the molten metal bath causes a rapid combination of oxygen and iron to form FeO in the confined central reaction zone . . .'' (col. 4, lines 43-66)

Several other references should be pointed out which indicate that the applicants were cognizant of and related the chemical reactions produced by physical impingement of the oxygen jet.

> ''. . . it is a characteristic of the process of the invention that in the confined zone of direct oxygen reaction at the surface of the molten metal bath, the oxidation products of the impurities in the pig iron, such as silicon and manganese, as well as the oxidized iron form an early fluid slag which is always very rich in oxides, that is, highly oxidizing. With the formation of the slag-metal emulsion, the iron oxide reacts with the carbon present in the bath, primarily outside of the direct oxygen-metal reaction zone, and since such slag-metal reactions, are endothermic, the molten bath is maintained cooler in the vicinity of the walls of the refining vessel or converter.'' (col. 5, lines 60-72)

[110] The patentees again differentiated between the mechanical action of the jet and its chemical action in these words:

> ''Under these conditions deep penetration of the molten metal bath is avoided, while the necessary displacement of the slag cover to maintain direct oxygen to molten metal contact is insured. However, in the unusual circumstances of an abnormally stiff slag cover, the blow may be initiated using mechanical means for penetrating the slag cover to establish oxygen to metal contact.'' (col. 9, lines 17-24)

We recognize that the blowing of the jet and the displacing of the slag by that means is also ''mechanical.''

It is illogical to dispute the fact that this refinement action is all physical action, especially in view of the detailed explanation of the sequential chemistry contained in the specification: First to the development of autogenous heat (col. 3, lines 66-67); second, to the development of "extremely high temperatures in the zone of direct oxygen contact with the molten metal which approaches the boiling point of iron" (col. 4, lines 50-53); third, to the movement of a portion of the iron oxide to the slag with the other oxidized elements and a portion diffusing into the bath under the influence of the bath circulation, so that within the first three minutes of the blowing, vigorous carbon combustion is initiated due to the high temp-[111] eratures developed by these reactions" (col. 4, lines 54-60); and fourth thereafter "the ensuing reaction of carbon with the FeO and directly with the oxygen gas in the confined direct oxidation zone [causing] rapid formation of carbon monoxide and the formation of this CO [causing] a strong boil or agitation of the bath. . . " (col. 4, lines 60-64). It is this boil or agitation of the CO which "arguments the bath circulation to continuosly present unrefined metal to the oxygen gas reaction zone and to create a slag-metal emulsion." (col. 4, lines 64-67)

We are also informed of the additional part which the high temperature plays in the process: ". . . it is a characteristic of the oxygen-steelmaking process that the high temperature developed in the reaction zone between the bath metal and the slag cause a rereduction of manganese from the slag into the bath during the latter portion of the refining period." (col. 7, lines 29-34) In this connection the applicants tell us the important part they played because ". . . the early fluid basic and highly oxidizing slag formed provides an accelerated rate of phosphorus and sulphur removal from the bath, leaving the finished steel very low in both elements." (col. 6, lines 5-19)

[112] In the patent in suit, once the manual or physical action is provided, the resultant chemical action becomes dominant. Thus, within the physical parameters set by the operator, the chemical reaction of the components involved remain relatively independent.

The Suess specification teaches that the high temperature is self-generated—autogenous (col. 3, line 25), and up to now we know that the oxygen jet contacts the oxidizable elements contained in the iron bath, and that this produces the high temperature. Accordingly, the *autogenous generation of heat is the chemical result of the physical impingement of the oxygen on the oxidizable elements* contained in the bath.

Thus, reduced to its simple components, the patent wording separates the physical or mechanical from the chemical reactions. The steelmaker applies the oxygen jet and as long as he does, it is a physical action; and the oxygen coming in contact with the oxidizable elements combines and reacts in a natural way, and as long as that occurs it is a chemical. If the oxygen is stopped at any moment by the steelmaker, the chemical reactions will also stop.[22] If the elements are completely oxidized, the chemical **[113]** reactions cease.[23]

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[22] This was demonstrated on a number of occasions, but particularly as movies were made at Linz, Austria, in testing the direction of rudders in the molten bath of a 50-ton ladle for a 30-ton test plant, the oxygen was turned on and off for each demonstration. As the oxygen was turned on the flares of light showing the outthrow became instantly visible and as the oxygen was turned off, the flares of light abated. (PX-161, see also PX36C, 36D and 185A.) In this respect the application of oxygen as an oxidizing element in the exothermic process shows similarity to the application of electric current in the electrolytic process which is endothermic.

[23] The specification specifically provides: "The vigorous boil . . . continues up to the carbon end point . . . when the flame dies and carbon combustion is completed, the bath becomes relatively quiet and intimate contact between the slag and metal bath ceases." (col. 6 lines 62-69)

Up to here I have set forth in a detailed fashion the chemical action which results when the oxygen and metal contact is made. I do not deem it necessary to analyze the specification as it describes further chemical actions. I merely point out that the original combination of oxygen and oxidizable products produces heat and so expands. Thus, I note the movement of the iron oxide and the carbon monoxide as it is formed in the impingement-reaction zone into the bath where their high temperatures are diffused onto less heated portions within the bath and so produce further chemical reaction. (col. 4, lines 54-75, col. 5, lines 1-5) The latter continue after the bath elements are cooled to return to the reaction center at the [114] center surface of the bath, where they become reheated and again pass down into the bath for the sequential or cyclical diffusion of heat into the other portions of the bath. This endothermic chemical reaction and secondary conversion process continues until the free carbon supply is exhausted at which time no matter how much oxygen is supplied, the bath becomes relatively quiet; (col. 6, lines 66-72). With the quieting of the bath and with the failure of the oxygen jet to have any further effect, the chemistry is completed. The lack of activity in the bath, after the carbon end point has been attained clearly dispells the theory of physically induced circulation.

[115] **VI. Circulation—How Induced**

Mr. Justice Matthews said (*Eames* v. *Andrews*, supra, 122 U.S. at page 56):

> "An inventor may be ignorant of the scientific principle, or he may think he knows it and yet be uncertain, or he may be confident as to what it is, and others may think differently. All that is immaterial, if by the specification the thing to be done is so set forth that it can be reproduced."

The question is whether or not the scientific principles involved here were misinterpreted, or misunderstood by the

McLouth Courts to such an extent that any such misinterpretation without fault of the plaintiffs, contributed to an inequitable determination.[24]

I repeat one of the excerpts found in the *McLouth* District Court Opinion:

> "Thus none of the references in the specification relied on by plaintiffs teaches *in so many words* that circulation of the bath is produced by chemical reactions as claimed." (Emphasis added). (257 F. Supp. at page 437).

It must be remembered that the specific references were not [116] addressed to lawyers or judges but to those skilled in the art of steelmaking. 35 U.S.C. § 112. Thus it is not necessary that every detail be precisely explained.

In searching the record for an answer as to whether there was a misinterpretation of the law as it relates to scientific principles, I noted some confusing language by defendant's counsel apparently for the purpose of showing that the specification taught that the oxygen jet caused the "bath circulation" and that this preceded the oxygen-iron FeO formation. During the cross-examination of Dr. Hauttmann (R. 2515) the following colloquy took place between counsel for the defendant and the District Court: (R. 2516-2517)

> "Mr. Groner: Column 4, line 54: 'A portion of the iron oxide goes to the slag', and then it goes on to say a second portion 'diffuses into the bath under the influence of the bath circulation'; but it does not even suggest, as the witness has already testified, that any chemical reaction induces the bath circulation. The bath circulation distributes the iron oxide.

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[24] I said (V at page 20), that I did not need to examine the scientific principles or truths involved in the Suess et al. process, and was only doing so to ascertain whether any misconception of those scientific prnicipies or misinterpretation of the wording of the specification set forth was instrumental in bringing about a final determination which worked an injustice without fault of the plaintiffs.

THE COURT: What isn't clear to me is this first sentence here, 'A portion of the iron oxide goes to the slag'. The iron oxide of what, and where did it come from?

Mr. Groner: The iron oxide which is caused by the combination of the carbon with the oxygen—or with the iron and oxygen to form FeO. Actually, if you went back to line 43, Your Honor——

[117] THE COURT: Yes, I understand that it is iron mixed with oxygen to create iron oxide, but it starts right out here by saying, 'A portion of the iron oxide goes to the slag with the other oxidized elements and a portion—that is, a portion of the iron oxide—diffuses into the bath under the influence of the bath circulation.'

Mr. Groner: Well, now, the only question with which we are here concerned, your Honor, is what causes the bath circulation . . . And obviously this sentence here presupposes that the bath circulation has already been created and set into motion. *There is nothing here that deals with the creation of a circulation*—certainly one induced by reaction—and the circulation as such is created, or at least the only description of the patent dealing with the creation is that which occurs in column 4, lines 26 to 38." (Emphasis added)

Even if one accepts the contention of counsel for the defendant that there is nothing in the specification which deals with the creation of a circulation, the tests both in *McLouth* and *J & L* as well as the discussion of counsel and the witnesses demonstrate that a circulation does occur in the bath. Furthermore, the specification said "It is believed that the application of the oxygen jet . . . *brings* about a flow in the molten metal . . ." (Emphasis added) (col. 4, lines 27-31)

Even though counsel for the plaintiffs conceded that there were no words which stated that the oxygen jet originated the circulation, the *McLouth* District Court concluded that the circulation was of a physical origin and found that "The [118] specification teaches a circulation brought about by the jet . . ." (257 F.Supp. at page 437) It held that col. 4,

lines 28-34 of the specification "teaches that chemical reactions produce only an 'agitation of the bath' rather than circulation, and that the agitation thus produced merely 'augments' the circulation already in existence." (257 F. Supp. at page 436) By this last statement I assume that the District Court meant "the circulation already in existence" was caused by what it strongly inferred was the physical action in the oxygen jet.

In col. 4, lines 28-34, the specification speaks of the *belief* that the oxygen jet applied as instructed *"brings about a flow* in the molten metal from the center of the surface of the bath downwardly . . ." (Emphasis added). (Col. 4, lines 30-32). Yet the *McLouth* District Court separates this from the chemical actions which are related in the same sentence, ". . . so that portions of the unrefined metal are continuously *presented to a localized center of direct oxygen reaction* with the bath metal, while *reacted or oxidized* portions of the bath *move away from this reaction center.*" (Emphasis added). (Col. 4, lines 34-38). Again, all of this is the patentees' belief about the "apparent circulation of the molten material" (Col. 4, lines 27-28, 38-39).

[119] I have already explained that the only hold for a determination that the circulation in the bath was physically caused on the basis of the words "brings about a flow" in in the theory belief portion of the specification of the action or mechanism of the process, commencing with col. 4, lines 26 et seq., and particularly as the words "brings about a flow" are contained in line 30. As I have already indicated this is not a statement of the physical cause for the circulation, but rather a theory of the chemical reaction upon "application of the oxygen jet". This is, however, explained when the patentees describe the chemical action after impingement has been made and ignition occurs within the first minute of flowing. Thus the oxidation reaction "develops extremely high temperatures in the zone of direct oxygen contact with the molten metal", whereupon "a portion of

the iron oxide goes to the slag with the other oxidized elements and a portion diffuses into the bath under the influence of the bath circulation." Here now the patentees assert that their former statement of "brings about a flow in the molten metal" is enhanced by the development of the "extremely high temperatures in the zone of direct oxygen contact [120] with the molten metal." Under these circumstances there should be no ambiguity for the person skilled in the art of steelmaking, or for that matter to the chemist. In any event, there is no room here for an inference that the oxygen jet physically produces a circulation in the bath. As we shall see later the testimony of all of the expert witnesses indicated at the most that all the oxygen jet could possibly do was to create a bend or hollowing or indent in the surface of the bath, but that this did not cause, according to one of the experts from the Massachusetts Institute of Technology, more than that. But even if any ambiguity existed here, the interpretation should be made in an effort to save the patent.

From hereon, the specification teaches that as the molten metal reaches "the boiling point of iron . . . within the first three minutes of the blowing vigorous carbon combustion is initiated due to the high temperatures developed by these reactions. The ensuing reaction of carbon with the FeO and directly with the oxygen gas in the confined direct oxidation zone causes rapid formation of carbon monoxide and the formation of this CO causes a strong boil or agitation of the bath, which augments the bath circulation to continuously present unrefined metal to the [121] oxygen gas reaction zone . . ." (Col. 4, lines 52-65). It is obvious then that the carbon combustion increases the boiling action, and this "strong boil or agitation of the bath" is in itself a moving force that augments the movement in the bath to "continuously present unrefined metal to the oxygen gas reaction zone and to create a slag-metal emulsion."

Thus we see that the first oxidation process resulting from the oxidation of iron, silicon, manganese and other impurities creates the first phase or high temperature activity in the central surface portion of the bath, i.e., "in the zone of direct oxygen contact with the molten metal" (Col. 4, lines 51-52). The boil then initiates the second phase of the chemical process as it moves upwardly and downwardly into the bath and away from the "zone of direct oxygen contact with the molten metal". As the patentees indicate, this "represents, for the most part, primarily endothermic reduction of FeO by carbon to form the evolved carbon monoxide, which reaction thus effectively *encompasses* the zone of direct oxygen reaction at which the highest temperatures prevail . . ." (Col. 4, line 75, Col. 5, lines 1-4).

Accordingly, it appears these have been technically set out [122] so that experts skilled in the art of steelmaking, including Durrer and Hellbruegge, could understand it.

In any event, none of these references support any finding that a circulation in the molten metal bath is physically or mechanically brought about by the force of the oxygen jet. Wherefore, it cannot be said that the specification so states. Rather the implication of the specification is strong that circulation occurs as a result of chemical action.

No one has been able to look inside a seething vessel when oxygen is blown in accordance with the Suess process, although some testimony was presented by the McLouth experts that they looked into model demonstrations and were able to see an upwardly directed circulation. Thus, at the least, the beliefs of the patentees are scientific theories which they need not prove and which in fact need not even be true. *Reeves Bros. Inc.* v. *U. S. Laminating Corp.*, 282 F. Supp. 118 (D.C.N.Y. 1968) Aff. 417 F. 2d 869 (C.A. 2—1969).

I have personally observed these operations in Ashland, Kentucky and at the defendant's mill at Aliquippa, Penn-

sylvania. From first hand knowledge I know that after the molten contents are placed in the vessel, the vessel is righted and the oxygen is turned on. Immediately fireworks erupt from the top of the vessel, and a rumbling noise ensues. After some twenty minutes, [123] more or less, while the oxygen is still flowing, the fireworks and the rumbling subside following which the oxygen jet is withdrawn. No one of the *McLouth* or *J & L* witnesses disputed the existence of these visible and audible phenomena. And so as I have seen, the process starts and comes to an end both visibly and audibly, while the operators stand by. The natural laws of chemistry produce these phenomena from beginning of the application of the oxygen to the end of the oxidation process in which we see the refinement of crude molten iron into finished steel.

A patent validity determination must ultimately be based on the specification as it relates to the scope of the invention. Nevertheless, where technical matters are contained in such a patent, it is appropriate for a trial judge to consider the expert opinions given by such witnesses and give them such weight as he determines they deserve. But the conclusions of such witnesses are not binding on the court. This is true whether the opinion evidence is addressed to a judge, a jury or to a statutory board. *Dayton Power & Light Co.* v. *Public Utilities Commission*, 292 U.S. 290, 299, (1934). Where, however, an expert witness testifies to relevant factual circumstances, such testimony is no different from non-expert witnesses.

[124] William David Smith, the Superintendent of the Steel Purchasing Department of J. & L at Aliquippa, Pennsylvania testified before me concerning audibility and visibility in the basic oxygen furnace. First as relates to the beginning of the operation, he testified: (R. 3984)

Direct Examination

"Q. What happens so far as the operator can see when the oxygen first strikes the molten iron?

A. The first thing that happens is that we get ignition between the oxygen and the molten iron. A flame evolves out of the mouth of the furnace, which we term ignition.

Q. Is the operation a quiet one?

A. No, sir. It is very loud."

And later as follows: (R. 3988-3989)

Q. Now, have you observed any vibration of the vessel or the lance during a blow?

A. Yes, sir. The furnace vibrates slightly within the limits of the herringbone gear on the drive that permits it to walk a little bit. Also, the lance will vibrate while we are blowing.

Q. Can you tell by sound or otherwise whether there is any churning or sloshing inside of the vessel?

. . .

A. Well, you can watch the ejections from the furnace and the flame and the sound. Yes, there is movement going on, there is action inside the furnace.

[125] Q. Is it mild or moderate or more than moderate?

A. No. It is rather violent and dynamic.

THE COURT: Something on the order of a very small volcano, if you ever heard anything about volcanos.

THE WITNESS: Yes, sir, very much.

THE COURT: Volcanic in action.

THE WITNESS: That is right.

THE COURT: Because of a certain amount of turbulence that you may not see but feel?

THE WITNESS: But you know it is there.

THE COURT: And because of the smoke and the other matters we see, sparks and the like, that are erupted after ignition?

THE WITNESS: That is correct.

THE COURT: Not before ignition?

THE WITNESS: Yes, sir, that is correct.

THE COURT: What do you hear before ignition?

THE WITNESS: Before, sir, the only thing you might hear is some crackling and reaction between the hot metal and the scrap going on."

I have mentioned that anyone who views the basic oxygen process from beginning to end has both visual and audible evidence of when it starts and when it is completed. The specification merely indicates that there are the visible [126] effects of flame and fume at the very beginning and the quieting of the bath at the end of the carbon oxidation reaction. (col. 4, lines 43-54; col. 6, lines 67-69).

While it is impossible to see inside the seething vessel after the oxygen jet has been applied, scientists can by applying known scientific principles theoretically arrive at an appraisal of what is occurring above and within the bath.

In an attempt to demonstrate what was occurring in the bath, innumerable tests were presented to the *McLouth* District Court and here. However, the *McLouth* District Court gave no credence to the plaintiffs' demonstrations.

> "An 'explosive bubble' mechanism which would tend to justify a conclusion that reaction-induced circulation in a molten metal bath could be down in the center was advanced by Dr. Chipman and Dr. Shapiro for the first time at the trial of this litigation in 1963 and 1964 (R. 480-482, 490-492, 496-500, 3696-3698) and was admittedly not contained in any literature prior to the time of trial. (R. 4250-4251)." (257 F.Supp. at 438)

The fact that the methods were not shown to be contained in prior literature, does not in itself discredit their validity as demonstrative techniques.

Although defendant's experts presented several demon- [127] strations, the *McLouth* District Court concerned itself with a series conducted at the University of Michigan at

Ann Arbor. One of these, Demonstration No. 7, was discussed and extensively relied upon in the Opinion to support the defendant's contention that with deep penetration, good steel could be produced, even though the refractory bottom was damaged. Despite this, the Opinion contained a finding that McLouth practiced the Suess et al. process (257 F.Supp. at page 386), and that "avoidance of deep penetration was the gist of the [Suess et al.] patent". (257 F.Supp. 403, 406)

Although the patentees did make specific declarations of the chemistry of the process, they did not in the specification or in the claims "in so many words" state what the actual direction of the circulation was; only that this was "an apparent" circulation which they "believed" was downward in the center, outwardly at the bottom, upwardly at the sides and then inwardly at the top to the center. (col 4, lines 27-38) However, I keep in mind that Mr. Justice Matthews said in *Eames* v. *Andrews, supra,* (122 U.S. at page 26) that it was not incumbent upon the patentees to understand the scientific principles involved, and that they may have been mistaken.

The plaintiffs produced an impressive number of eminent **[128]** witnesses, particularly from the Massachusetts Institute of Technology, who testified on the chemistry and fluid dynamics involved in the Suess process. They testified that the impingement of the oxygen jet created the chemical reaction which resulted in high temperatures and caused both an upward as well as a downward movement in the bath. They testified that the deeper insertion or deeper penetration of the jet into the bath created a mechanical or physical force the net result of which reversed the overall direction of circulation and at the same time had the tendency to cause damage to the bottom and wall refractories. Although there was some disagreement even amongst the plaintiffs' experts, it was insubstantial and for the most part all agreed to the brief statement which I have just made.

The defendant's experts did not dispute that a circulation existed in the specific oxygen vessel as the process was applied. However, they contended that the direction was opposite to that indicated by the plaintiffs' experts, that is, that the movement was upward in the center [25] and outward at the top, downward [129] at the sides and inward at the bottom. This they attributed to the mechanical injection of the jet into the bath. Furthermore they stated the only way the bottom of the refractories would be injured was by causing the oxygen jet to come in contact with that portion of the refractory.[26]

The testimony of the defendant's experts was presented in support of its contention that it practiced deep penetration of the oxygen jet in accordance with the prior teachings of Schwarz and Miles. However, the Opinion contained a finding to the contrary. (257 F.Supp. at page 380)

Thermal expansion, movement and circulation are an inherent part of the specification as it teaches in col. 4, lines 43-54, that initial contact of the oxygen jet with the molten metal bath causes "a rapid combination" in the formation of FeO and that this is demonstrated by ignition and a visible flame in the first minute of blowing, and further oxidation of the impurities such as silicon and manganese [130] "develops extremely high temperatures approaching the boiling point of iron as demonstrated by a fume."

While the theories of direction and cause of circulation flow in the molten bath continued to be disputed by the ex-

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[25] These witnesses never mentioned the recoil factor, concerning which I speak of later.

[26] As I said previously, I speak of this later (Comp. XIII) when I discuss a ruling contained in the Opinion on Demonstration No. 7 as conducted by the defendant at Ann Arbor, Michigan. Although I do indicate in that discussion that the Superintendent of the McLouth mills had testified that when the oxygen jet was injected into the empty vessel it did not damage the refractories. (PX-J-33 p. 11,100, Johnson)

perts on both sides, an effort was made by the defendant's experts to show that the Suess process was in reality a restatement of the prior arts of Schwarz and Miles, additionally containing only the *belief* of circulation direction in the bath. In spite of the contentions of the defendants' experts, they nevertheless factually supported the chemistry explanations contained in the specification. For example, Dr. Flinn said that (PX-J-21 p. 6886):

> "The reaction of iron with oxygen would lead to a temperature increase."

Then, again he made certain answers as follows: (PX-J-25 p 8279A)

> "Q. Now, what is the condition that you have there, Doctor, from the standpoint of what you observe coming out of the converter?
>
> A. I observe fume and flame.
>
> Q. Is that ignition?
>
> A. Yes.
>
> • • •
>
> "THE COURT: How much time has elapsed?
>
> • • •

[131] A. . . . That is about five seconds . . .

> Q. About five seconds, and what is the condition which you see at the mouth of the converter?
>
> A. Smoke and flame."

In describing the beginning of the regular vessel operations at the McLouth OP shops, the testimony of Lyle Johnson another of defendant's witnesses, is more specific: (PX-J-32 p 10989)

> "Q. (By Mr. Groner) In a normal blow about how long does it take, just by way of contrast?
>
> A. Normally ignition occurs almost immediately."

And at (PX-J-33 p 11061)

"Q. Can you tell us what 'ignition' means when related to the jetting of oxygen on a bath of molten iron?

A. Ignition means the reaction of the oxygen with the iron or the impurities in the iron and is evidenced by an increase in temperature.

Q. Is there other evidence of the presence of ignition?

A. An evidence of the presence of ignition is usually smoke and visible flame . . ."

(PX-J-33 pp. 11228-11229):

"Q. This matter of ignition really signals the beginning of the oxygen refining process, does it not?

A. Yes, Mr. Webb.

[132] Q. In other words, it would be correct to say, would it not, that the process does not start until ignition occurs?

A. Yes, Mr. Webb, that would be correct . . . I would state ignition in the commercial operation to be the appearance of smoke and a visible flame at the mouth of the vessel."

This testimony of the defendant's witnesses is in accord with those of the plaintiff's expert witnesses as regards this phenomenon. Dr. Chipman said (PX-J-2 pp. 381-382):

"The ignition is a phenomenon which is recognizable by sound and also by the first appearance of a massive smoke emerging from the vessel. This has to do with the rapid burning going on at the junction of the oxygen with the metal surface.

. . .

THE COURT: You say the entire surface of the bath is momentarily burning?

A. Burning. Uniting with the oxygen. Not the entire surface of the bath, your Honor.

THE COURT: I see.

A. The entire surface of this impingement area.

THE COURT: Of the impingement area?

A. Yes.

THE COURT: I see."

Earlier Dr. Chipman said (PX-J-2 p. 384):

". . . Here the burning of the surface, the extraordinarily strong oxidizing reactions **[133]** between the oxygen and the metal bath, have heated the area of impingement to a quite high temperature, very commonly referred to as the hot spot or the area of impingement, and chemical reactions have set in here in full vigor . . . First, there is the development of the very high temperature. Second, . . . many bits of metal are thrown upwardly . . .

THE COURT: What is it that is thrown out, you say?

A. Metal. Hot metal is thrown out under oxidizing conditions . . ."

Then this is said (PX-J-2 p. 385):

"Now, other things show up as a consequence of the chemical reactions. One of these, and a very important one, is a downward central blow of metal immediately under the highly heated surface area . . .

THE COURT: You say that downward flow of the metal is caused by this chemical reaction?

A. It is caused by the chemical reaction in the heated zone. The flux materials are not much changed yet, because here we are talking about the first 15 seconds after ignition . . ."

Dr. Chipman also said (PX-J-3 p. 481):

"The impingement of the oxygen on the bath surface raises the temperature by chemical reaction, increases the temperature of the metal on the immediate surface to a quite high temperature . . .

The reaction of iron oxide in the hot spot with carbon is violent enough at 2900. At 4800 . . . I think to say it is explosive is not an exaggeration."

[134] And further (PX-J-3 p. 500):

> "Q. How soon after your heat is started, Doctor—that is, after the blow of the oxygen starts—do you realize this condition which you have described at the hot spot where you have these explosive reactions?
>
> A. This condition begins with the phenomenon which we call ignition . . . and the phenomenon of ignition marks the beginning of the evolution of a huge cloud of smoke. It marks the beginning of certain sounds which are clearly audible, . . ."

In this connection, Dr. Elliott said (PX-J-19 pp. 6120-6120-A):

> ". . . the fact that iron boils at this very high temperature would indicate that there were extremely high temperatures in the reaction zone. This is characteristic of high temperature reactions in the steel industry, the generation of iron fume. Where that occurs, one is sure that the temperatures are very high.
>
> Q. (By Mr. John Webb) Approximately what temperature?
>
> A. 4500 to 4900 degrees Fahrenheit."

Up to now we see that the contact of the oxygen jet, after it pierced the slag, with the metal surface produced certain chemical combinations which resulted in (1) heat and (2) a certain amount of movement. Although the creation of heat is spelled out quite clearly in a number of places, movement is not clearly stated. However, since the chemical actions and reactions are stated, one skilled in the art of [135] steelmaking will understand that movement is involved when the chemical actions are spelled out as they are in the specification.

The Opinion concluded that chemical reactions are not taught to be a factor creating circulation, and found particularly that, "This reference does not teach that when chemical reactions cease, circulation of the bath also ceases. Thus,

no casual connection is made explicit in this reference between chemical reactions and circulation." (257 F.Supp. at page 436)

First of all we have the information from the specification, itself (and confirmed by all the experts), that almost immediately ignition takes place and soon "extremely high temperatures in the zone of direct oxygen contact with the molten metal" results.

To say that upon ignition and the beginning of the generation of heat by the oxidation reaction, the Suess process equilibrium of the molten metal bath remains static and the same as it was before the oxidation process commenced, would be absurd. It is common knowledge that substances expand as they get hotter. Expansion resulting from heat energy is called [136] thermal expansion.[37] Expansion is the act or process of increasing in extent, size, number or scope. The word "expansion" is also defined as meaning to spread out, to diffuse, to make to occupy more space.[38] This means motion or movement: "[The] intermingling of particles of matter with other particles, moving under their own power from a region of higher to one of lower concentration is called diffusion.[39]

With ignition the specification tells us that "a portion of the iron oxide *goes to the slag* with the other oxidized elements and a portion *diffuses into the bath* . . ." (col. 4, lines 54-56). In describing the commencing action, it will be seen that the specification uses the words "goes" and "diffuses". These words, it will be observed, are descriptive of the chemical action after the jet has impinged and made

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[37] Energies, Forms and Changes by Brandywine, Stohlberg & Burnett, 1968, at page 190.

[38] Webster's New Collegiate Dictionary, 1949, at page 290.

[39] Chemistry in Action, 4th Ed., 1941, at page 109, by Rawlins, Struble and Gatewood.

contact with the metal, and after chemical action has been initiated by means of ignition and flame. With an understanding of the cause of the circulation as being a result of chemistry, there should [137] be no misunderstanding about the terminology "brings about a flow in the molten metal from the center of the surface of the bath downwardly . . .", as this exists in the preceding paragraph describing what the patentees believe is the apparent movement in the bath. This then does not mean that the words in the previous paragraph "that application of the oxygen jet substantially vertically or approximately vertically upon the central portion of the bath surface *brings about* a flow in the molten metal" as a mechanical result and of the action of the steelmaker, but rather the words, "brings about a flow" (col. 4, line 30), "iron oxide goes to the slag" (col. 4, line 55), and "a portion diffuses into the bath" (col. 4, line 56) speaks simply of resultant chemical action.

I have elaborated on these words and their definitions in the specification in an effort to ascertain whether there is any significance in their context or content as used in the Suess specification. Since ignition and heat as the result of oxidation reaction occurs upon the impingement of the oxygent jet to the molten metal bath surface it is chemically self-explanatory. Obviously, then, expansion, movement and circulation are inherently a part of the specification's word picture as it commences with the description contained in the [138] specification (col. 4, lines 43-48) ". . . initial contact of the high purity oxygen jet with the molten metal bath causes a rapid combination of oxygen and iron . . ."

The complaint by the *McLouth* defendant which the *McLouth* District Court approved was not that the circulation in the bath was not chemically produced, but that rather the specification did not say so "in so many words as claimed." I have been discussing the specification's chemical reactions in the first few seconds when ignition and chemical actions were visible to witnesses both for McLouth

and for the plaintiffs, and which I observed the result thereof was movement.

Witnesses, however, spoke of another incident involved in these chemical reactions. After the first minute or so when the specification says "the high temperatures . . . approach the boiling point of iron . . .", this "extremely high temperature" causes the carbon and the oxygen gas in the confined direct oxidation zone to form carbon monoxide and in doing so, initiates a "strong boil or agitation of the bath, which augments the bath circulation . . ." (col. 4, lines 50-65) It will be observed here that the specification speaks of both the boiling iron and the formation of the carbon monoxide as occurring in the impingement areas of the oxygen and molten metal [139] bath, and that it is here that the carbon monoxide begins its agitation and augmentation of the circulation which already exists. We now know scientifically that circulation as worded in the specification originated with ignition at the point of oxygen to metal contact.

I have searched the *McLouth* record for testimony from the defense experts relating to the character of the activity in the industrial oxygen process vessel, and find very little which will be helpful in regard to the matter which I am about to discuss.

Dr. Nicholls said (PX-J-26 p. 8871):

> "A. Combustion is a chemical reaction, an oxidation process, . . ."

Further on, he said (PX-J-27 p. 9007):

> "In a combustion process, for an explosion, you must have ignition. You have to get that fire going."

However, he did discuss something of the explosive character of carbon monoxide.

Dr. Chipman testified quite elaborately in behalf of the plaintiffs in this regard (PX-J-2 p. 384).

> "Here the burning of the surface, the extraordinarily strong oxidizing reactions between the oxygen and the metal bath, have [140] heated the area of impingement to a quite high temperature, very commonly referred to as the hot spot or the area of impingement, and chemical reactions have set in here in full vigor."

He first called attention to the fact that this reaction causes a throw-out of many bits of metal upwardly, and he then said: (PX-J-2 p. 384):

> "The throw-out here is due to chemical reactions occurring in this highly heated zone."

The Court asked him a question and he answered as follows (PX-J-2 p. 384):

> "THE COURT: What is it that is thrown out, you say?
>
> A. Metal. Hot metal is thrown out under oxidizing conditions, and it is undergoing oxidation as it is thrown out of the furnace."

He said on another occasion (PX-J-3 pp. 490-491) that the iron oxide dissolved at that temperature in the heated zone and oxygen dissolved with it also dissolves carbon in the metal, all of which reacts very rapidly forming bubbles of carbon monoxide (CO). He said that this CO burns quite rapidly in oxygen, but that "a mixture of CO and oxygen is an explosive mixture which results in violent explosive formation of CO_2. He then testified that (PX-J-3 pp. 496-498) the upthrow of metal also results in a downward thrust "as a sort of kick from [141] the outthrow, a downward thrust on the metal, and bubbles of CO are shot downward." He said, too, that (PX-J-3 p. 498), the downward stream carries hot metal—very hot metal. He testified that (PX-J-3 p. 498), "The downward stream of metal carries with it downwardly dissolved oxygen, dissolved carbon, dissolved silicon, and dissolved manganese. These are all in solution in this downward stream." He testified that (PX-J-2 p. 388) "These bubbles of carbon monoxide are formed at this

very high temperature with extreme rapidity, and this gives rise to the forces which thrown these sparks upward and also which exert this downward push." He was then asked:

> "THE COURT: What flows downward? Is it the carbon monoxide bubbles, or—
>
> A. Yes.
>
> THE COURT: Or is it the flow of iron?
>
> A. It is both."

When previously asked by the Court "You say the downward flow of the metal is caused by this chemical action?" The answer was "It is caused by the chemical reaction in the heated zone." (PX-J-2 p. 385) He said that (PX-J-2 p. 385):

> ". . . as a consequence of the chemical reactions . . . a very important one, is a downward central blow of metal immediately under the highly heated surface area."

[142] He continued to state that the reactions going on are both quite violent, both throw metal upwardly from the bath, both have a tendency to push downwardly in the bath, and both contribute to the rapid establishment of this circulatory movement downwardly below the hot spot. (PX-J-3 p. 491) Specifically at (PX-J-3 p. 497) he said:

> "The surface condition is quite tumultuous. Oxygen and CO come into contact with one another on the surface and react violently to form carbon dioxide . . . The explosion of these bubbles, the rapid formation of CO bubbles, which is effectively explosive in violence, throws metal upward."

It also has a downward thrust resulting "as a sort of kick from the out-throw, a downward thrust on the metal, and bubbles of CO are shot downward." (PX-J-3 p. 498).

The Court asked Dr. Chipman (PX-J-3 p. 498):

> "THE COURT: I think you have answered this before, but will you explain again to me, unless you are going to develop that . . . just what causes this downward flow of the metal in the central part of the bath under the reaction zone.
>
> A. . . . I would say it is a kick of something shot up. There is a kick downward against the metal."

Thus it is that we have expert opinion supports for the scientific explanations contained in the specification. First, [143] as a result of movement caused by high temperature, a portion of the FeO goes into the slag, and a portion of it is diffused into the bath; and second, thereafter, the boiling of the iron and the high temperature, formation of carbon monoxide, combining further with the oxygen, starting explosions with an upward push as well as a downward kickback into the bath.

Thus to the expert, plainly enough, the specifications does say that the chemical action is the result of the combining of the oxygen with the various other chemical elements; that such combination or oxidation produces unusually high temperatures and certain behavior in the bath evidenced by flame, fume, boiling of the bath and turbulence, and that when the turbulence comes to an end, the chemical reaction comes to an end. The oxygen jet no longer causes any action.

We keep in mind that the complaint by McLouth which the *McLouth* District Court approved, was not that the circulation in the bath was not chemically produced, but that rather the specification did not say so "in so many words as claimed."

I find that natural laws, as they fall within the classification of chemistry, produce the circulation phenomena from beginning to end of the refinement of molten iron metal into finished steel.

[144] **VII. Localized Reaction Zone**

If the Suess patent process is to be used by any person skilled in the art of steelmaking, it would seem he must know and understand the meaning and significance of the term "localized reaction zone" as set forth in the claims and as taught by synonymous expressions in the specification. This is so because the "triggering mechanism" the specification instructs, lies in the zone where oxygen and iron meet, under "controlled conditions".

The preliminary issues here revolve about whether or not the plaintiffs in *McLouth* sufficiently explained this factor to the *McLouth* District Court or, without fault on the plaintiffs' part, that Court utilized a fundamental misconception as to the technical significance of the "localized reaction zone."

The defendants in *McLouth* denied that there was such a thing as a reaction zone which was localized, or which could be localized, or that the term had any factual significance. They attempted by various experts and by demonstrations at Ann Arbor, particularly Nos. 5, 7 and 9, to show that by following [145] the prior art of Schwarz and Miles they could produce "good" or "ductile" steel. The fact that McLouth persuaded the District Court that the localized reaction zone and material agitation were a fiction, resulted not so much from the proof which the defendant presented in these regards, but rather from the District Courts conviction that "avoidance of deep penetration was the gist of the invention."

> "As for the 'localized reaction zone spaced a substantial distance from the refractory lining,' such a reaction zone could also exist even with deep penetration." (257 F.Supp. at page 426)

This conclusion was premised on a prior determination that:

> " 'The localized reaction zone spaced a substantial distance from the refractory lining' and the 'high tem-

> perature' in such reaction zone are features of the claim which this Court considers anticipated by the Schwarz and Miles patents and therefore certainly obvious to persons skilled in the art.' (257 F.Supp. at page 404)[30]

[146] Since the Opinion does not divorce "avoidance of deep penetration" from "localized reaction zone", it held:

> ". . . plaintiffs cannot read the avoidance of deep penetration into the language of the claims referring to an impact 'a localized reaction zone spaced a substantial distance from the refractory lining' " (257 F.Supp. at page 426)

The Opinion does not find that a localized reaction zone did not exist, but refused to find that it existed at the top or central surface as set out in the specification and in Claim 1. What it found was that there was a reaction "anywhere the oxygen stream [might have engaged] the metal bath" (257 F.Supp. at page 439). The truth of this statement is uncontradicted as Dr. Chipman testified in response to the Court's inquiry [147] concerning reaction zones:

> "THE COURT: It is anywhere the oxygen stream may engage the metal bath. Is that what you are saying?

---

[30] This finding is based on conclusions as to Schwarz that:

> " '• • • the reaction between oxygen and iron or iron-accompanying substances with the phenomena resulting therefrom, namely *local* over-heating and the accumulation of ferrous oxide, takes place in the center of the steel bath and therefore the walls of the vessel are not substantially attacked . . .' " (Emphasis added) (257 F.Supp. at page 404)

and

> "Miles' teaching that 'the source of chemical oxidation reaction is located within the bath at a good distance from the refractory lining' *implies* a localized reaction zone, and, further Miles' teaching of blowing oxidizable elements in with the jet to 'increase the temperature *locally* where the jet strikes the bath so as to bring about the oxidizing action more rapidly' *suggests* a localized reaction zone with higher temperatures than the rest of the bath." (Emphasis added) (257 F.Supp. at pages 404-405)

A. Yes, your Honor." (PX-J4 p. 909)

The high affinity and rapid combination of oxygen and iron occurs whenever oxygen is placed in intimate contact with molten iron. Since iron exists throughout the entire molten bath in which the oxygen jet is injected, it is quite logical to assume that when the jet is penetrated deeply into the bath that oxidation will occur throughout the bath. It is obvious then that whether one elects to practice Schwarz, Miles, Durrer, Hellbruegge or Suess, depending upon what degree of refinement and preservation of refractories and quality of steel one desires to achieve, a chemically induced reaction between the oxygen and the metal bath occurs.

Under these circumstances our inquiry leads to this question: Do the Suess specifications and claims actually teach a "localized reaction zone", which differs from the oxidation-reduction area prescribed by the prior art?

Miles uses the word "locally" for the purpose of indicating an increase in temperature where the jet strikes within the bath so as to bring about "the oxidizing action more [148] rapidly". In Miles, (DX-10A, page 3, lines 17-19): "The high speed of the fluid jet has the effect that the source of chemical oxidation reaction is located *within the bath at a good distance from the refractory lining.*" (Emphasis added). This practice is more specifically set forth by Schwarz (DX-5A, page 4, lines 24-25 and page 5, line 1) because "local overheating and *accumulation of ferrous oxide, takes place in the center of the steel bath . . .*" by which it is stated that the ferrous oxide formed from the oxidation-reaction of oxygen and iron and producing high heat *is localized in the center of the bath* away from the walls of the vessel.

As relates to the prior art reaction zone, the first two sentences of the Schwarz patent are pertinent:

> "If liquid baths, for instance metal baths, are to be treated with gases, it is important to bring the reactants

into as intimate contact with each other as possible. *Surface contact is not sufficient in most cases* to produce a rapid reaction, such as the blowing of the gas *over* the surface of the bath or the mere blowing of the gas *onto* the surface of the bath." (DX-5A p. 1, lines 1-7) (Emphasis added)

The localized reaction zone of Suess is located at the central surface of the bath, where the oxygen is blown vertically "through the slag layer onto and below the surface of the [149] bath at the central portion thereof." This not only preserves the refractories but promotes adequate phosphorus removal.

Dr. Chipman testified (PX-J-4 pp. 1016-1017) that in the prior art the injection of the jet deep into the bath produces an elongated oxidizing agent in the molten metal, and wherever that instrumentality contacts oxidizable materials, it produces oxidation reaction no matter how such a jet or jets are lengthened, and whether horizontally or partially horizontally layered, the hot region accompanies the entire circumferential length as the instrumentality comes into contact with the bath material. Under the prior art, then, the reaction area or zone was unlimited and unconfined, i.e. not "localized".

The obvious significance of the Suess process lies in the understanding, particularly by one skilled in the art of steelmaking, that the oxygen jet in Suess creates an oxygen to metal contact area in a critically confined and localized zone at the central surface of the bath. Thus the Suess specification teaches the creation of a hot spot by impingement of the oxygen to create a locale of oxygen-metal reaction at the central surface of the bath, in contra-distinction to the prior art which provides for a dissemination of oxygen [150] throughout the bath. In the prior art high temperature was caused indiscriminately wherever the oxidation process occurred within the interior of the bath; in the case of Suess, high temperature is controlled and limited to a

very restricted reaction zone at the central surface of the bath.

It seems that this understanding of the technical difference may not have been properly clarified in the prior Courts, because the term "hot spot" which is used to describe reactive areas was indiscriminately employed in both the prior art and Suess. This contributed to the District Courts finding that:

> "The 'localized reaction zone spaced a substantial distance from the refractory lining' and the 'high temperature' in such reaction zone are features of the claims which this Court considers anticipated by the Schwarz and Miles patents and therefore certainly obvious to persons skilled in the art." (257 F.Supp. at page 404).

The difficulty with this thinking is first, that the "localized reaction zone" of the Suess specification is being removed from its "localization" at the central surface of the bath and equated with the Schwarz-Miles reaction areas throughout the bath; and second, that neither Schwarz nor Miles produced successful results so far as the refining of pig iron into [151] steel by oxygen was concerned.

We must therefore examine the relevant portions of the Suess specification for the purpose of determining whether there is any difference in the placement of the reaction center and the reasons therefor as distinguished from the prior art. Such demonstrations are numerous:

> ". . . portions of the unrefined metal are continuously presented to a *localized center* of direct oxygen reaction with the bath metal . . ." (col. 4, lines 34-36) (Emphasis added)
>
> ". . . develops extremely high temperatures in the *zone of direct oxygen contact* with the molten metal . . ." (col. 4, lines 50-52) (Emphasis added)
>
> "The ensuing reaction of carbon with the FeO and directly with the oxygen gas *in the confined direct oxi-*

dation zone causes rapid formation . . ." (col. 4, lines 60-62) (Emphasis added)

". . . which augments the bath circulation to continuously present unrefined metal to the *oxygen gas reaction zone* . . ." (col. 4, lines 64-66) (Emphasis added)

". . . thus effectively encompasses the *zone of direct oxygen reaction* . . ." (col. 5, lines 2-3) (Emphasis added)

". . . it is a characteristic of the process of the invention that in the *confined zone of direct oxygen reaction at the surface* of the molten metal bath, the oxidation products . . ." (col. 5, lines 60-63) (Emphasis added)

[152] ". . . the iron oxide reacts with the carbon present in the bath, primarily *outside of the direct oxygen-metal reaction zone* . . ." (col. 5, lines 67-69) (Emphasis added)

"An equal amount of heat is absorbed *outside of the confined central zone of direct oxidation* as the FeO (as silicate) is reduced by the carbon in the bath . . ." (col. 5, line 75 to col. 6, lines 1-2) (Emphasis added)

". . . with the induced circulation of the bath metal toward and away from the *central zone of direct oxygen reaction* . . ." (col. 6, lines 63-65) (Emphasis added)

". . . it is characteristic of this oxygen steel making process that the high temperatures developed in the *reaction zone between the bath metal and the slag* cause . . ." (col. 7, lines 29-32) (Emphasis added)

". . . the *contact of the oxygen with the bath* resulting in reaction of the oxygen with a portion of the iron and with the oxidizable impurities of the bath in a localized reaction zone . . ." (col. 12, lines 16-19) (Emphasis added)

That the *reaction zone is localized at the surface* is indicated by the various references in the specification relating to the impingement of the oxygen jet *on the surface* by *vertical* and central blowing:

". . . with a high purity oxygen jet impinging *vertically* or *approximately vertically* on the *melt surface* sub-

stantially at the *central portion thereof* . . ." (col. 3, lines 18-20) (Emphasis added)

[153]

"In so operating, the area of jet impingement is controlled to produce *a relatively confined zone of direct oxygen to molten metal contact* with respect to the total *surface area* of the bath." (col. 3, lines 46-49) (Emphasis added)

"This vigorous boiling action is opposed by the pressure of the oxygen jet *only in the area of impingement, and outside of this area* it represents primarily endothermic reduction of FeO by carbon to form the evolved carbon monoxide, which reaction thus effectively encompasses the *zone of direct oxygen reaction* at which the highest temperatures prevail affording a maximum measure of protection to the refractory lining of the refining vessel." (col. 4, lines 72-75 to col. 5 lines 1-5) (Emphasis added)

". . . and is *confined to an impingement area at the central portion of the bath surface.*" (col. 4, lines 71-72) (Emphasis added)

". . . high oxygen efficiency is obtainable acording to the the process of the invention when the oxygen jet *impinges on the central portion of the molten bath surface* from directly above, that is, approximately *vertically.*" (col. 5, lines 30-34) (Emphasis added)

"The turbulence of the bath and slag due to the oxygen stream *impinging from directly above* is insufficient to cause continuance of oxygen metal reaction." (col. 6, lines 69-72) (Emphasis added)

And as to both localized reaction zone and impingement, the following.

". . . the *impingement area* of the high purity oxygen on the *central portion* of the bath isolates [154] the refractory walls of the refining vessel from the extremely high temperatures which are developed by the *direct reaction* of the oxygen and and the molten metal." (col. 4, lines 1-6) (Emphasis added)

That the reaction zone is not deep is reflected in the descriptive words as follows:

> "According to the process of the invention . . . [certain matters are prescribed] such that direct contact of the oxygen jet and the molten metal is established and maintained throughout the refining period *without deep penetration* of the molten metal bath by the jet." (col. 3, lines 36-46) (Emphasis added)
>
> "The process conducted under these conditions *avoids a deep penetration* of the oxygen gas into the molten bath . . ." (col. 3, lines 73-75) (Emphasis added)
>
> "The oxygen jet thus contacts the emulsion of bath and slag components which presents a larger reaction surface and causes the refining reactions to progress rapidly *although the oxygen jet does not penetrate deeply* into the molten metal bath and *is* confined *to an impingement area at the central portion of the bath surface.*" (col. 4, lines 67-72) (Emphasis added)
>
> "*Under these conditions, deep penetration of the molten metal both is avoided, while the necessary displacement of the slag cover to main direct oxygen to molten metal contact is insured.* (col. 9, lines 17-20) (Emphasis added)

From the instructions as a whole it may be seen that the patentees are presenting the idea of an oxygen jet impinging vertically on the central surface area of the molten bath and [155] in this way confining and localizing the center of oxygen to metal contact area or zone for the generation of high temperature of oxidation-reaction. By so doing the operator may control the chemistry involved in the process. That it is a surface center or zone seems to be emphasized by the fact that the word "surface" is used approximately 30 times throughout the Suess patent.

The specification also finds support in the testimony of the experts.

When asked about the process's placement of the "hot spot" which contained the high temperatures, Dr. Chipman replied (PX-J-3 pp. 441-441A):

"A. The hot spot is generated at a point as far from the refractory as one can get in the vessel; namely, with respect to the surface area of the bath, it is at the center, which gives you the maximum distance from the side wall.

With respect to height or depth in the bath, the hot spot must be held reasonably near to the surface of the bath so that it does not extend deeply into the bath to sufficient depth to damage the bottom refractory . . . two principal areas from which the heat zone must be held far enough to avoid undue damage . . . are the *periphery* of the bath where the bath and side wall come into contact and the *bottom* of the vessel immediately under the hot spot." (Emphasis added)

[156] But that was not the only reason why the hot spot was localized in such a position, because, as he testified, if the high temperature was spread over a wider area of the surface the dissipation of heat necessary to create circulation would diminish "the chemical force which sets the bath into motion." In addition, this location is essential for providing iron oxide for the slag, which is essential for phosphorous control. (PX-J-3 pp. 442-443) If the jet is embedded or blown deeply into the bath, it not only destroys the refractories, but also hampers the chemical refining operations involved in the process. As related to the hot spot, Dr. Chipman in answer to questions stated (PX-J-4 pp. 1016-1017):

"Q. . . . Now do I understand from this that the hot spot develops at the bottom of the cavity made by the penetrating jet?

A. All over the cavity.

Q. And that occurs without regard to the depth of the cavity?

A. Yes. The hot spot develops all over the cavity without regard to the depth."

He also stated in answer to questions (PX-J-4 p. 1017):

"Q. I take it that the hot spot that you speak of there develops all over the cavity when you practice the teachings of Schwarz; is that so, Doctor?

A. I think so.

[157] Q. You can't avoid it, can you?

A. I don't think you can avoid it.

Q. And it happens when you practice the teaching of Miles?

A. Blowing oxygen onto and into the bath, you can't avoid the high temperatures."

It was unfortunate that the word "spot" was used in this particular testimony and not "region" or "area" to differentiate the Miles-Schwarz "area" from the "zone" in Suess.

For example Dr. Elliott testified (PX-J-19 pp. 6061-6062):

"The oxygen jet is to be operated to generate a localized high temperature reaction zone—that is the hot spot—which is confined to the upper central portion of the bath . . ."

Also, a little further

"The patent is very explicit in this regard, that the oxygen, when it is blown onto and just below the surface of this bath, can react to oxidize such things as iron, silicon, phosphorus, manganese, and in this it generates an enormous amount of heat, it reacts with carbon, it generates both heat and gas, and there results a very high temperature, and this high temperature region is confined to the area of impingement."

Dr. Elliott also testified (PX-J-19 pp. 6064-6065):

". . . this teaches the presence of the confined central region which is at a high temperature because of the reactions. It teaches that one must confine this region in order to protect the refractories . . . [a]nd [158] to obtain control of the chemical reactions in the process."

Dr. Elliott further explained what happens to the "hot spot" when it is extended to deeply into the bath (PX-J-19 pp. 6072-6074):

> "(By Mr. John Webb): What effect does the size of the localized reaction zone that you have been talking about have on the FeO content of the slag?
>
> A. I'm talking in the first case primarily of the vertical extent of this reaction zone. If it is too deep into the metal, the oxygen goes to the metal without forming iron oxide or forming insufficient iron oxide . . .
>
> THE COURT: You mean this hot spot extends too deep?
>
> A. If the reaction zone extends too deeply——
>
> THE COURT: Well, what is the difference?
>
> A. Well, if it gets too deep, it may not be the hot spot any more because of the effect of the bath on this.
>
> THE COURT: Wait a minute. I thought you were talking about this localized reaction zone and the hot spot as one and the same thing.
>
> A. If it is conducted properly, yes.
>
> THE COURT: Well, state that again. See if I can understand it.
>
> A. If the volume of engagement between the oxygen and the bath is too deeply imbedded in the bath, there will be difficulty getting iron oxide formed.
>
> [159] THE COURT: You are saying if the oxygen jet becomes too deeply imbedded in the bath? Is that it?
>
> A. Yes, sir.
>
> THE COURT: Then what happens?
>
> A. There will be insufficient iron oxide formed. This will prevent the slag from doing its work in removing phosphorus."

He also testified (PX-J-19 p. 6074) that phosphorus control is not the only indicator in the process. Others, he testified, were refractory wear, control of chemical reactions and

frothing of the slag, as exemplified by the following colloquy (PX-J-19 pp. 6074-6076):

"THE COURT: . . . You are speaking here about the indicators of a proper localized reaction zone. This localized reaction zone is *one* of the essential elements of this patent.

A. Yes.

THE COURT: And the indicators of that, *one is excessive wear* of the refractory lining; is that right?

A. Yes, sir.

THE COURT: Another indicator, would you say, is improper or excessive foaming of the slag?

A. May I suggest that we consider the prime subject as control of the chemical reactions, and the *foaming slag would be one* example of the indicators under this title.

THE COURT: Chemical reaction doesn't mean [160] anything. I will put it down the way you say. The chemical reaction, and under that you have foaming slag.

A. Slag condition, foamy slag, yes.

THE COURT: And what else under that chemical reaction indicator?

A. Phosphorus content of the bath." (Emphasis added)

Dr. Elliott on direct stated (PX-J-19 pp. 6080-6081):

"Q. Now would you explain what they mean by the term 'fluid slag', how that enters into this discussion?

A. Slags tend to be creamy in character, like a thick cream, when they are properly formed. If there is undissolved material in the slag like refractory material, little piece of refractory ever so small, the slag gets a consistency like partially melted ice cream.

I am reminded of the residual that is left when my small children eat ice cream. They stir it around. Some of it is partially frozen and some of it is liquid, and it is a little bit lumpy and a little bit thick. This is what we call a—it is not a completely dissolved slag.

The slag does not have all of its components in solution, and if there are various refractory materials being brought into the slag, such as magnesia, which is in the refractory, this tendency will be evident, lumpy and thick slag.

On the other hand, in the other direction, if the slag has excessive amounts of iron oxide in it, it may well be watery, take on the consistency of kerosene, whereas one would look on, say, castor oil as more typically fluid.
[161]

Q. What would cause this excess of FeO in the slag that would give it this character that you discussed?

A. This could conceivably result from the operator working with his lance too high so that, in fact, the reaction zone is not even located in the bath, that it is located in the slag. This would be an extreme case."

Dr. Elliott based his statement of the existence of the localized reaction zone on three points: (1) that he had conducted a series of laboratory experiments, which were both observed and photographed, and the temperature rose very rapidly as the oxygen was brought in contact with the bath, which indicated a very large release of heat from these reactions and that upon measurement the resulting temperature of this reaction zone was found to be 4000 to 5200 degrees Fahrenheit; (2) from the emergence of fume and dust from the mouth of the vessel and from the fact that in steelmaking operations this fume is always associated with very high temperatures, he concluded that there was a hot spot in the McLouth operations; and (3) by the Linz thermocouple test, which showed that when one of the thermocouples was located essentially directly under the area of impingement of the oxygen jet on the bath, a very rapid rise in temperature occurred **[162]** and the thermocouple was quickly destroyed. This indicated the existence of the hot reactive region at the oxygen-iron contact point. Other thermo-

couples located further away were not destroyed and their temperatures did not rise rapidly.

John Edward Prince testified in both *McLouth* and *J & L* (R.3643) that in the L-D process the direct reaction was at the surface and occurred in the indent. He said also that the reaction zone and the indent are substantially co-extensive. Mr. Felix Wallner testifying for the plaintiffs in these instant cases said (R. 1218-1219) that he conducted the Linz thermocouple tests; that the "zone of the bath with the higher temperatures is located below the oxygen jet as it impinges upon the surface of the bath."

The specification described "a low static pressure at the point of origin" for the blowing of the oxygen by the jet within certain limitations (col. 3, lines 52-64) in order to produce a "sufficiently high reaction velocity of the oxygen with the bath constituents" (col. 3, lines 63-65), "consistent with controlled temperature and control and development of other necessary and required process conditions, such as fluid slag, avoidance of over-oxidation (undue loss of iron to the slag), and avoidance of slopping. (col. 3, lines 68-72).

[163] In endeavoring to read the specification as would one skilled in the art of steelmaking, I conclude that this reference provides a highly abbreviated statement of the process. This impression seems to be strengthened by what the foremost expert of his time, Dr. Durrer wrote in the December 14, 1949 memorandum (DX-110-E J&L) (DX 89B(20)McL):

> "The good results consist in particular in the very low contents of carbon, phosphorous and sulfur, *which contradicts all metallurgical* expectations. This work shows a new metallurgy with which we must first of all become acquainted. Presumably, the extensive removal of these substances is *due to the higher temperature, the higher degree of liquidity, connected therewith and*

the higher reaction velocity resulting therefrom." (Emphasis added)

The Suess patentees promised a "sufficiently high reaction velocity of the oxygen with the bath constituents" (col. 3, lines 63-65), and that this provides and insures the "development of autogenous heat" sufficient for the "completion of the refining in a minimum of time, consistent with controlled temperature and control and development of . . . fluid slag, avoidance of over oxidation (undue loss of iron to the slag), and avoidance of slopping." (col. 3, lines 63-72) And this all comes about by the instructions preceding these statements "according to the process of the invention." (col. 3 **[164]** line 36). It will also be seen here that the "static pressure at the point of origin" in accordance with the limitations imposed by the foregoing instructions has some force at the place of impingement. However, the specification says that this "pressure of the oxygen jet" opposes the vigorous boiling action produced by the oxidation of the iron, silicon, manganese and other impurities and carbon as it "is confined to an impingement area at the central portion of the bath surface." (col. 4, lines 60-72).

This confined zone of impingement area has been identified by the experts on both sides as an "indent". For instance, when Dr. Hauttmann was asked a question, he made this answer (PX-J-8 p. 2400):

> "Q. Doctor, would you explain a little more in detail what you mean by the word 'indent'?
>
> A. This is the deformation of the surface in the part in which it is hit by the oxygen jet."

Dr. Elliott described it in this way (PX-J-20 pp. 6411-6412):

> "A. The 'localized reaction zone' in the claim is synonymous with the 'confined central reaction zone'. It is

also synonymous with the term 'relatively confined zone' where there is implicit in the statement of the sentence where that appears that there is a reaction going on.

[165] THE COURT: You say that the term 'localized reaction zone' in the claim has the same meaning as which terms used in the specification?

A. The 'confined central reaction zone.'

THE COURT: And anything else?

A. And the 'relatively confined zone' where they are speaking of a reaction going on. The sentence often indicates there is a reaction, and they speak of a 'relatively confined zone.'

THE COURT: Those two terms as used in the specification have the same meaning as the term 'localized reaction zone' in the claim?

A. That is correct."

Dr. Shapiro testified (PX-J-12 p. 3739) that the volume of the indent is controlled by the momentum force of the jet and has no defined or regular shape but can be supposed in a reasonable way to have a shape whose cross section is like a parabola. If the depth of the parabolic figure and its volume are known, the breadth of the indent can be reckoned and also the force as that force acting frictionally tangential is further projected to mechanically supply a proportionately high pound weight force of about 6.6 pounds (the pounds of force tangentially applied is equal to 350 pounds) to a melt of some 200,000 pounds weight. The Court asked how 6½ pounds can make a 12 inch indent, and Dr. Shapiro explained that the [166] force which makes the indent is not 6½ pounds but is about 350 pounds. The 6½ pounds is the total force applied tangentially to the surface. He stated that he proved in his demonstration that it is only the frictional force tangentially to the indent which can physically set the bath into motion. The downward force, which is 350 pounds in this

case can only produce an indent. It canot produce motion in the bath.

The word "indent" appears nowhere in the Suess patent. How and why then should it enter into any consideration here? I have already set forth circumstances that the jet controls the shape, extent and direction of the oxidation-reaction path. If the reaction zone of the Suess patent, as they describe it, is to be surface-oriented or surface-localized as the oxygen impinges upon and makes contact with the metal and contains the generating chemistry in iron refining, then we ought to know how it is done.

And this is so, I again repeat, even though the law does not require an inventor to know what the scientific principles are in his invention, but only that it works. *Standard Coil Products Co. Inc.* v. *General Electric Co.*, 306 F.2d 319, C.A. 2, 1962.

[166.1] It seems to me that the mechanical or physical action within the control of the operators meets its conclusion with the impingement of the oxygen jet upon the molten metal surface and that at that time—and place of impingement, there begins the chemical reaction over which the operator has no control, except through the physical and mechanical application. Here then is the key and critical part of the process which must sustain the patent's phenomenon, if it has any phenomenon at all. Here in the place of impingement on the surface at the center of the bath and at the place where the experts say an indent occurs, must be the answer to the success of the Suess patent as it discloses the failures of the prior art.

[167] **VIII. Substantial Distance**

Claim 1 of the Suess patent speaks of a localized reaction zone spaced "a *substantial distance* from the refractory lining." (col. 12, lines 19-20). Thus the *McLouth* rulings on localized reaction zone are intimately linked with the rulings on substantial distance.

The District Court held:

> "Indeed the Schwarz and Miles Patents which taught deep penetration also referred at least indirectly to the existence of such reaction zone a substantial distance from the refractory lining. (DX 61, Schwarz, pp. 4-5; Miles, pp. 3, 15, 16). Deep penetration of the bath by the oxygen jet as taught by Schwarz and Miles might well extend to a depth of two-thirds of the bath, for example, still leaving a 'substantial distance' of one-third of the bath depth between the reaction zone and the refractory lining. The term 'substantial distance' is not given any definite meaning by the patent in suit, and the patent certainly does not teach that one-third of the bath depth, for example, would not be a 'substantial distance' within the meaning of the claims." (257 F.Supp. at page 426).

The word "substantial" may not be one which lends itself to precise definition. But it gains significance from the context in which it is used.

In *Ewald* vs. *Commissioner of Internal Revenue,* 141 [168] F. 2d 750, 752 C.A. 6, 1944, Judge Hamilton said:

> "The word 'substantial' is susceptible of different meanings according to the circumstances of its use and is variously defined as actual, essential, material or fundamental."

In *Newark Stove Co.* v. *Gray & Dudley Co.,* 39 F. Supp. 992, 994 (D.C.M.D. Tenn. 1941) a patent was held to be infringed because the claim substantially involved patent principles. Judge Davies said:

> "And if we were to say that the law provides that, merely because a door in the furnace manufactured by the defendant is not as large and does not occupy the same space as called for in Claim 10 of the patent, yet, on the other hand, has all of the desirable features of the patent itself, the principle of the reflective radiation, particularly, I think we would be going far afield from the equitable application of the law regarding patents."

In *Steelton Borough's Election* case, 129 Pa. Super. 302, 307 (1937), where the term "substantial error" was included in a statute providing for the opening of any ballot box, it was held:

> "The word 'substantial' is susceptible to different meanings according to the circumstances."

The following references in the specification are indicative of central and surface placement of the oxygen jet:

> ". . . impinging vertically or approximately vertically on the melt *surface substantially* at the *central* portion portion thereof . . ." (col. 3, lines 18-20). (Emphasis added).
>
> ". . . the high purity oxygen jet is blown vertically, or approximately vertically upon the *central* portion of the *surface* of a bath of the molton metal . . ." (col. 3, lines 36-39). (Emphasis added).

[169] "In so operating, the area of jet impingement is controlled to produce *a relatively confined zone of direct oxygen to molten metal contact* with respect to the total *surface* area of the bath." (col. 3, lines 46-50). (Emphasis added).

> ". . . application of the oxygen jet *substantially* vertically or approximately vertically upon the *central* portion of the bath *surface* . . ." (col. 4, lines 28-30). (Emphasis added).
>
> ". . . when the oxygen jet impinges on the *central* portion of the molten bath *surface* from directly above, that is, approximately vertically." (col. 5, lines 31-34). (Emphasis added).
>
> ". . . it is a characteristic of the process of the invention that in the confined zone of direct oxygen reaction at the *surface* of the molten metal bath, . . ." (col. 5, lines 60-62). (Emphasis added).

It then adds:

> "The process conducted under these conditions avoids a deep penetration of the oxygen gas into the molten

bath which seriously impairs refractory life at the bottom of the refining vessel. In addition, the *impingement area* of the high purity oxygen on the *central portion of the bath* isolates the refractory walls of the refining vessel from the extremely high temperatures which are developed by the direct reaction of the oxygen and the molten metal." (col. 3, lines 72-75, to col. 4, lines 1-6). (Emphasis added).

"In carrying out the process of high purity oxygen refining of a molten bath of pig iron, the refining vessel is of such design and the charge is of such amount that the ratio of the depth of the molten bath in meters to the surface area of the molten bath in square meters should be from about 1 to 5 to about 1 to 28 in refining vessels of various design [170] or in terms of the ratio of depth to diameter of a circular bath between 1:2.5 and 1:19. In other metallurgical processes to which the present invention is adapted, substantially similar ratios may be used." (col. 4, lines 15-25).

"The oxygen jet thus *contacts the emulsion of bath and slag components* (interface) which presents a larger reaction surface and causes the refining reactions to progress rapidly, although the oxygen jet does not penetrate deeply into the molten metal bath and *is confined to an impingement area at the central portion of the bath surface.*" (col. 4, lines 67-72). (Emphasis added).

". . . (I)t is a characteristic of the process of the invention that in the *confined zone of direct oxygen reaction at the surface* of the molten metal bath, the oxidation products of the impurities in the pig iron, such as silicon and manganese, as well as the oxidized iron form an early fluid slag which is always very rich in oxides, that is, highly oxidizing." (col. 5, lines 60-66). (Emphasis added).

"Under these conditions, deep penetration of the molten metal bath is avoided, *while the necessary displacement of the slag cover to maintain direct oxygen to molten metal contact* is insured. However, in the unusual circumstances of an abnormally stiff slag cover, the blow may be initiated using mechanical means for

penetrating the slag cover *to establish oxygen to metal contact.*" (col. 9, lines 17-24). (Emphasis added).

"However, it is a characteristic of this oxygen steel making process that the high temperatures developed *in the reaction zone between the bath metal and the slag* cause a rereduction of manganese from the slag into the bath . . ." (col. 7, lines 29-33). (Emphasis added).

This last reference is indicative of interface oxidation activity which obviously is at the surface of the molten metal bath.

[171] Without further detailing reference terms, the specification's broad explanations relating to the bath's "surface", oxygen jet "impingement", and reaction" zones and areas, in their varible or synonymous expressions—all, as a whole—picture oxygen jet nozzle placement centrally at the bath surface and at the furthermost spot away from the bottom and side walls of the vessel.

There is very little left to the imagination after these instructions are provided in the specification. First, we know that the oxygen jet is to impinge upon the bath surface at its central point, and by the simple method of geometry we can very easily ascertain the central point of a circular or other shaped area. Accordingly, this would confirm and support the wording "a substantial distance from the refractory lining" since the central point is not only a substantial distance but includes the farthest point from any of the lateral refractory walls. Since the oxygen has impinged upon the surface and caused a local reaction zone at the central surface, it is undoubtedly a substantial distance from the bottom. Accordingly, it is easily understood not to "extend to a depth of two-thirds of the bath, for example, still leaving 'a substantial distance' of one-third of the bath depth between the reaction zone and the refractory lining." (257 F. Supp. at p. 426). It is [172] centrally located at

a place where the oxygen jet pressure "in a range from about 5 to 25 atmospheres above normal atmospheric pressure" impinges "onto and below" the metal bath "surface". Actually, then, we need no experts to give meaning or significance to the references contained in the specification on the term "substantial distance" as used in the claim of the Suess patent.

Thus, the words of Claim 1 "in a localized reaction zone spaced a substantial distance from the refractory lining" take supports from two different sections: first, from Claim 1 itself which contains revealing explanations that the discharge of "a stream of oxygen (is to be) vertically downwardly through the slag layer onto and below the surface of the bath at the central portion thereof" (col. 12, lines 12-15). This identifies the discharge as having sufficient strength to pierce the slag and strike the surface of the bath superficially. This is then further explained by the words "the contact of the oxygen with the bath" (col. 12, lines 16-17, as this contact is limited in Claim 2 by reason of the fact that "the oxygen is blown into said vessel under pressure in a range between five and about twenty-five atmospheres above normal atmospheric pressure" (col. 12, lines 31-33). Secondly, the references just quoted from the specification give it specific supports and this is in accordance with law. *United States* v. *Adams*, 383 U.S. 39 (1966); *Ethyl Corp.* v. *Borden, Inc.*, 427 F. 2d 206, C.A. 3, 1970; *Schmidinger* v. *Welsh*, 383 F. 2d 455, C.A. 3, 1967, cert. den. 390 U.S. 946.

[173] The law of patents does not condemn the phraseology used here. A phrase used in connection with a process, described in a patent, is not a fatal defect for want of definiteness where the specification gives meaning to the phrase. *Sales Affiliates* v. *Hutzler Bros. Co.*, 71 F. Supp. 287 (D.C.Md. 1947), aff'd. 164 F. 2d 260, C.A. 4, 1947. It is not necessary to detail intricacies *ad absurdum* since the skill of the inquiring artisan must be taken into

account, and in addition where complexity dictates, broad terminology complies with the statute. *General Electric Co.* v. *Brenner,* 407 F. 2d 1258, 132 U.S. App. D.C. 323 (1968). It is the specification which must contain the necessary directions and instructions for teaching one skilled in the particular art, which relates to the subject matter of the patent, how to accomplish the results which are promised in the patent. *Application of Gay,* 309 F. 2d 769, C.C.P.A. 1962; *Hazeltine Research, Inc.* v. *Gage Electric Co., Inc.,* 271 F. 2d 218, C.A. 7, 1959. The specification of a patent need not explain every term and reference used if the meaning would be known to one skilled in the art. *General Electric Co.* v. *Brenner,* supra.

Thus, the term "substatial distance" in the phraseology of the claim "in a localized reaction zone spaced a substantial distance from the refractory lining" is given highly adequate **[174]** meaning by the specification of the patent in suit and the subject matter of the claims, as the maximum distance of the localized reaction zone from the bottom and wall refractory lining of the vessel.

[175] **IX. Onto and Below**

The District Court Opinion contains the finding that the term "onto and below" contained in Claim 1, in the phraseology "discharging a stream of oxygen vertically downwardly through the slag layer onto and below the surface of the bath at the central portion thereof" (col. 12, lines 12-14) is overbroad because ". . . there is no reference anywhere in the specification to blowing 'below the surface', as claimed." (257 F.Supp. at page 438). The District Court Opinion reasons that col. 5, lines 61-62 which speak of the "confined zone of direct oxygen reaction at the surface of the molten metal bath", which would seem to preclude a claim of blowing below the surface, would also suggest that the word "below" would cover even a deep penetration of the bath by the oxygen stream "which

is certainly not taught by the specification." (257 F.Supp. at page 438)

In any event, it said "Blowing 'onto and below the surface' is certainly taught by the Schwarz and Miles patents". (257 F.Supp. at page 439), and that this was so in spite of the fact that the Opinion acknowledged that there existed "a practically negligible penetration" of the surface of the molten metal by the words "onto and below" we are aware of the fact that they are [176] both relative terms and their meaning is to be determined by the surrounding facts and circumstances. *Eibel Process Co.* v. *Minnesota & Ontario Paper Co.*, 261 U.S. 45, 65-66 (1923). But more significant is the fact that both words appear in combination, so that to hold that one word "below" would seem to cover even deep penetration of the bath by the oxygen stream is at once an exclusion of the other component word "upon" as they are together read in connection with the words "surface of the bath". Thus, the word "upon" the surface, of necessity, excludes the idea of deep penetration by the oxygen jet. Furthermore, it would directly contradict the words contained in the specification generally which direct that the oxygen be caused to impinge upon the metal surface so as to make contact of oxygen with metal and as such process "avoids deep penetration" or functions in a certain way "although" the oxygen jet does not penetrate deeply into the bath. In other words, it would be inconsistent to here read the word "below" within the meaning of the specification itself as covering "even deep penetration of the bath by the oxygen stream." "Onto and below" combined as they are, survive a too strict interpretation as placed on the term by the District Court Opinion, because [177] such phraseology finds foundation in the patent terminology as a whole. *Long Mfg. Co. Inc.*, v. *Holliday*, 246 F.2d 95 (C.A. 4, 1957) *Autogiro Co. of America* v. *U.S.* 384 F.2d 391 (U.S.C.C. 1967)

In truth a patent should not be struck down or its claims necessarily limited where a reasonable construction of the specifications and claims will protect the inventor, *Corning Glass Works* v. *Anchor Hocking Glass Corporation, supra,* and has meaning to one skilled in the art of steelmaking. *Loom Co.* v. *Higgins,* 105 U.S. 580 (1882); *Carnegie Steel* v. *Cambria Iron* 185 U.S. 403 (1902).

If the word "below" had been used here alone, the interpretation contained in the District Court Opinion would be correct. But when the word "below" is used conjointly with "onto", then this connotation affects the meaning of both words. Accordingly, it is proper to apply to this context the maxim noscitur a sociis (it is known from its associates).

> "It is an ancient and well-known maxim, that is frequently applied and summarizes the rule both of language and of law. It is sometimes referred to as a legal doctrine; a rule of canon of construction, and it is applicable to all written instruments. The rule or maxim is to the effect that the meaning of a doubtful word may be ascertained by reference **[178]** to the meaning of words associated with it. Under this rule of *noscitur a sociis,* general and specific words, capable of analygous meaning, when used together, take color from each other, so that general words are restricted to a sense analogous to the less general, and the meaning of the word may be enlarged or restrained by reference to the object of the whole clause in which it is used." Corpus Juris Secondum, Vol. 66. page 607. See also: *Northway Village No. 3 Inc.* v. *Northway Properties Inc.* 244 A. 2d 47, 50, 430 Pa. 499 (1960); *Smedley Co.* v. *Employers Mutual Liability Ins. Co. of Wis.,* 123 A.2d 755, 758, 143 Conn. 510 (1956)

Under this rule, words capable of analogous meaning, when associated together, take color from each other and from the context in which they are used. I have no doubt whatsoever that "onto" and "below" were intended to

modify each other and the technical subject matter of he claims.

Surface Indent

Second. As we examine the phraseology containing the words in the claim "downwardly through the slag layer onto and below the surface of the bath", we immediately understand that the oxygen jet must penetrate the slag, and then blow upon the metal surface itself and make contact with it even to the extent of going below or disturbing the linear surface—so long as **[179]** it is only "to an extent to avoid material agitation of the bath by the oxygen stream". (col. 12, lines 15-16) [31]

Mr. Justice Brown in *Toplif* v. *Toplif*, 145 U.S. 156, (1892) said at page 171:

> "The object of the patent law is to secure to inventors a monopoly of what they have actually invented or discovered, and it ought not to be defeated by a too strict and technical adherence to the letter of the statute, or by the application of artificial rules of interpretation."

From an examination of the patent decisions, it is obvious that legal scribners have for a long time past had their documents related, translated and questioned, but few ever attained such competence as to be able to eliminate the legal assaults which inevitably exposed defects, or would-be defects, not anticipated by the scribner. So that while patentees are required to define their inventions with such particularity that would-be infringers know the metes and bounds of the legal protection to which the patentee is entitled *Palmer* v. *U.S.*, 423 F.2d 316 (Ct. Cls. 1970), a patent should not be struck down where a reasonable construction of the claims and **[180]** specification will protect the invention. *Corning Glass Works* v. *Anchor*

[31] I discussed this earlier *at Compendium IV*.

Hocking Glass Corp. 374 F.2d 473, C.A. 3, 1967, C.D. 389 U.S. 826 S.Ct. 65, 19 L.Ed.2d 80.

What Judge McLaughlin said there, I believe, is apt here. At page 376:

> "The District Court held that the Corning patent is '* * * a basic and pioneering advance in glass and ceramic technology.' 253 F.Supp. 461 at 465. We believe that Dr. Stookey's discovery is, in every sense of the word, a 'pioneer'—'* * * a patent covering a function never before performed, a wholly novel device, or one of such novelty and importance as to mark a distinct step in the progress of the art, as distinguished from a mere improvement or perfection of what has gone before.' *Westinghouse* v. *Boyden Power Brake Co.*, 170 U.S. 538, at 561, 562, 18 S.Ct. 707, at 718, 42 L.Ed. 1136 (1898). Where the court is confronted with such a pioneer patent liberality becomes the keynote of construction requiring the court to give the patentee a wide breadth of protection in construcing the patent claims and specifications. *Sessions* v. *Romadka*, 145 U.S. 29, 12 S.Ct. 799, 36 L.Ed. 609 (1892); *Consolidated Window Glass Co.* v. *Window Glass Mach. Co.* 261 F. 362 (3 Cir. 1919), cert. den. 251 U.S. 558, 40 S.Ct. 179, 64 L.Ed. 413 (1920); *Etten* v. *Kauffman*, 121 F.2d 137 (3 Cir. 1941)."

Judge McLaughlin quoted (at page 478) from *Georgia-Pacific Corp.*, v. *U. S. Plywood Corp.*, 258 F.2d 124, C.A. 2, 1958, cert. den. 358 U.S. 884, (1958):

> "'On the other hand, patentable inventions cannot always be described in terms of exact measurements,
> [181] symbols and formulae, and the applicant necessarily must use the meager tools provided by language, tools which admittedly lack exactitude and precision. If the claims read in the light of the specifications, reasonably apprise those skilled in the art both of the utilization and scope of the invention, and if the language is as precise as the subject matter permits, the courts can demand no more.' 258 F.2d 124, at 136."

That the Suess patent specification did reasonably apprise those skilled in the art of the utilization and scope of the invention was not questioned by the District Court Opinion.

> "In sum, this Court finds that the specification of the patent in suit, despite certain indefiniteness and inaccuracies, nevertheless complies with Section 112 by disclosing the invention in sufficiently clear terms to enable steelmakers 'to make and use the same.' At least defendant has not sustained its burden of proving otherwise, especially in light of defendant's own testimony that persons skilled in the art could make satisfactory steel following the teachings of the example and that extrapolation to other heat sizes was a simple matter." (257 F.Supp. at 424).

The particular significance of the combined words "onto and below", when read in context with the specification, find considerable support throughout, as they relate to "surface blowing" and "oxygen jet impingement" on the melt surface (col. 2, lines 47-51, 51-52, 65-66; col. 3, lines 18-22, 47-49; col. 4, lines 43-48). These are not all but they are representative of the situation, and they [182] exemplify some necessary supports under law, which, inadvertently, probably because of a lack of specified knowledge for interpreting the scientific values involved, remained imperceptible to the District Court. In particular this would seem to be the case when the District Court asserted that "the teachings of the patent . . . admittedly implies some penetration by the jet (R. 854), at least sufficient penetration to avoid slopping as specifically taught at col. 3, lines 70-75." (257 F.Supp. at page 422). The reasoning in this instance related to disagreement with McLouth's contention that surface blowing, as taught by the Suess specification, was "fatally indefinite" in the specification as required by §112. This holding alone by the District Court, it would seem, would have been sufficient to fulfill the interpretation that "onto and below" had a specific meaning descriptive of surface breach.

To those skilled in the art of steelmaking it is understood that a collision of oxygen charged with a force of from about 5 to 25 atmospheres above normal pressure ordinarily bores through or perforates the slag and makes contact with the surface of the bath. Accordingly they may understand, too, **[183]** that the jet will strike the metal surface with some remnant of the force remaining. Whatever that remaining force may be, it serves to disturb the linearity of the bath surface, and exerts a net force sufficient to act upon the impinged body so as to actuate it into a movement in the direction of the force by which it is being impelled. Thus the oxygen jet impingement, as prescribed by Suess, will create some denting or hollowing on the surface—no matter how trivial. So that there is in some degree the creation of a concavity or denting which literally lies below the bath surface plane.

The experts for both the plaintiffs and the defendant seem to accept the idea that at the place of contact of the oxygen jet with the molten metal an indent is created. Dr. Hauttmann explained that (PX-J-8 p. 2381) by "onto and below the surface of the bath" "is meant that a depression, an indent, is caused by the oxygen jet." At another time he said (PX-J-8 p. 2400):

> "This is the deformation of the surface in the part in which it is hit by the oxygen jet."

Dr. Shapiro testified that (PX-J-12 pp. 3738-3739):

> "The volume of the indent is controlled by the momentum force of the jet . . . we do not know the precise shape of this indent . . . one can suppose in a reasonable way that the indent has a shape whose cross-section is something like a parabola . . ."

[184] The McLouth witness also refer to the indent into the bath surface as made by the oxygen jet's impingement, although Dr. Richard A. Flinn stated in this way (PX-J-21 p. 7000)

> ". . . the jet penetrated the bath, producing a cavity, and ignition took place."

James A. Nicholls spoke of it in this way (PX-J-27 p. 8977),

> "The net result is an increase in indent or penetration because of the combustion effect."

Thus the indenting or bending of the surface would literally support the word "below" the planar surface as contained in the claim, even if it stood alone and without the conjoining word "upon."

Chemical Combinations Breach the Surface Plane

Third. Even assuming that there was no physical breach of the planar surface of the molten metal bath, when the oxygen jet impinged upon it, or bent it, or indented it, it would not necessarily follow that there would be no chemical infiltration by a combination of the atoms present in the oxygen and in the iron bath, which would then naturally disturb the linearity of the bath surface.

Aside from the fact that one condition necessary for a speedy combination of oxygen and iron is the high temperature of the iron, a second condition is required which would seem [185] to be fulfilled by the Suess patent applicants use of the word "impinge." The letter reflects that the oxygen jet must strike the bath surface with a force. Websters Third New International Dictionary, 1971, page 1134 defines the word "impinge" as meaning "to strike or dash especially with a sharp collision."

The word "impingement" in the references of the specification connotes a striking of the oxygen jet against the iron bath resulting in the combination of iron and oxygen as observed by the ignition and propagation of a fume (col. 4, lines 45-54). The context of the specification in this regard therefore indicates that the oxygen blowing has a

chemically penetrating effect. However one interprets the word "penetrate," it must come within the context of the words "onto and below the surface of the bath." It would also at the same time give significance to the words "without deep penetration" (col. 3, line 46), "The process conducted under these conditions avoids a deep penetration . . ." (col. 3, lines 73-74), and "Under these conditions, deep penetration of the molten metal bath is avoided . . ." (col. 9, lines 17-18).

[186] I conclude that in the light of all the instructions contained in the specification as to oxygen pressure, nozzle placement, ratio of bath depth to surface area of molten metal, and of all other instructions contained in the specification, and in accordance with the examples contained there, that a person skilled in the art of steelmaking will understand how to project or discharge the oxygen jet onto and below the surface of the bath, and so produce the promised steel in limited time and economy, and without unduly damaging the refractory linings of the vessel. Accordingly, the wording "onto and below" will not misdirect him into blowing the oxygen deeply into the bath in accordance with the prior practice of Schwarz and Miles.

I conclude that when the words "onto and below" are used in combination as related to the surface of the molten metal bath, such words take color from each other and that neither the meaning of "high" nor of "deep" may be attributed to the terminology, because the combining word delimits such meanings from surface positions or locations.

Because the oxygen jet disturbs the linearity of the bath **[187]** surface when blown upon it by producing a concavity or indent, such blowing supports the wording of of the claim "onto and below," because the surface linearity is literally breached.

When chemical combinations result in the formation of molecules, such combinations occur because oxygen and

iron have inter-penetrated each other. So, again, the blowing onto and below the surface of the bath by an oxygen jet, literally breaches the planar surface in the area of chemical combination.

[188] **X. Avoidance of Material Agitation**

Up to this point I have elaborated with considerable detail on what I have concluded are the foundational circumstances of these cases as required by *Blonder-Tongue*. I have done this in an effort to provide sufficient clarification of subject matter, which otherwise might have been complicated or confusing and thus misguiding. And while all the issues raised by the parties have not yet been discussed, it will not be necessary, as I now conclude, to treat these at length.

The objections to the rulings of the District Court on avoidance of material agitation were actually multiple in character. These include the findings that the claims do not measure the invention (257 F.Supp. at page 434); that there is no causal connection between "avoidance of deep penetration" (which plaintiffs allegedly abandoned) and "avoidance of material agitation" (257 F.Supp. at pages 426, 431); that "avoidance of material agitation" is not used or defined in the specification of the patent in suit (257 F.Supp. at page 428); that there was no antecedent language in the specification to support the terminology "avoidance of material agitation" in the claims (257 F. Supp. at page 429); that there was no correlation between "avoidance of deep penetration" and "avoidance of material agitation" (257 F. Supp. at pages 430, 434); that the "concept of avoidance of material agitation of the [189] bath by the jet would not have been meaningful to persons skilled in the art at the time the invention was made" (257 F.Supp. at page 431); that "the claim step of avoidance of material agitation of the bath by the oxygen stream is not supported by the specification of the patent in suit except in a very limited and perhaps meaningless way, and could not have been a mean-

ingful concept to persons skilled in the art at the time the invention was made" (257 F.Supp. at page 432); that "the concept of material agitation of the bath by the oxygen stream is purely fictional" (257 F.Supp. at page 432); that "it seems impossible that a deep penetration by the jet could overcome or even materially affect such circulation, so as to cause a material agitation by the oxygen stream" (257 F.Supp. at page 432); that there is "tangible evidence in the record tending to confirm the concept of material agitation by the oxygen stream is a fiction" (257 F.Supp. at page 433); that "the teaching of the specification to avoid deep penetration does not provide support for the language in the claims of the patent in suit 'to avoid material agitation of the bath by the oxygen stream' " (257 F.Supp. at page 434); that there was "an attempt to equate material agitation with deep penetration (257 F.Supp. at page 434); that "circulation cannot be both up and down in the center at the same time" (257 F.Supp. at page 435); that "the language in the claims concerning the avoidance of material agitation of the bath by [190] the oxygen stream," essential to novelty appears "to be mere surplusage in the claims" (257 F.Supp. at page 435); that "the real reason for the inclusion of language in the claims of the patent in suit concerning the avoidance of material agitation by the jet was the desire by the applicants to distinguish the prior art Miles patent, which expressly taught that the jet itself agitated the bath" (257 F.Supp. at page 435); that "in effect, the specification of the patent in suit presented a new theory of agitation caused by chemical reactions, and the claims referred to an avoidance of agitation by the jet to give the impression of an entirely new steelmaking process" (257 F.Supp. at page 435); and, that "even under the process as taught by Schwarz and Miles chemical reactions rather than the mechanical action of the jet must have been the actual cause of agitation . . ." and so "if Schwarz and Miles avoided material agitation of the bath by the oxygen stream even with deep blowing, then such avoidance of material agitation

by the oxygen stream cannot be considered a significant feature of the claims of the patent in suit" (257 F.Supp. at pages 435, 436). I shall discuss these generally.

Claim 1 speaks of "discharging a stream of oxygen vertically downwardly through the slag layer onto and below the surface of the bath at the central portion thereof, *to an extent to avoid material agitation of the bath by the oxygen* stream . . ." (Emphasis added) col. 12, lines 12-16). The word "agitation" appears only once in the claims and only once in **[191]** the specification. However, since it is incumbent upon us to give meaning to a word by examining the context of all the words with which they associate, *Northway Village No. 3, Inc.* v. *Northway Properties, Inc.*, 244 A.2d 47, 50, 430 Pa. 499 (1968), I conclude that the word "agitation" in the specification and the word "agitation" in Claim 1 are used in different senses.

In the specification it is used in a two-fold sense of first, a result of the rapid formation of carbon monoxide, and second, the result of activation or boiling augmenting the circulation already existing in the bath. As the word "agitation" is used in the specification, it is not used to designate the originating motion or action in the bath, but is itself a chemical result caused by "rapid formation of carbon monoxide" which causes the agitation of the bath. It is synonomously identified as "a strong boil," which augments the bath circulation to continuously present unrefined metal to the oxygen gas reaction zone. (Col. 4, lines 60-66). Thus the word "agitation" finds itself involved and identified with chemical action or "circulation" caused by the chemical reaction originating in a localized reaction zone at the place of the impingement of the oxygen with the metal (Col. 4, lines 26-75, col. 5, lines 1-5).

However, the word "agitation" contained in the claim is used in a causative sense, directing the functioning of the operator of the oxygen jet as a physical matter; and yet it is not an instruction of how to make the Suess process

functional, [192] but rather how not to interfere with its functioning as is taught in the prior art. It is very much like the instructions contained in the four places in the specification where it is stated that if the process is employed and the instructions are followed, avoidance of deep penetration results. Thus in the claim it is used in the sense of forestalling, by measures prescribed in advance, a possible interception or interference of the blowing of the oxygen downwardly through the slag layer onto and below the surface of the bath producing an unwanted physical stirring action in the bath. The reason for the admonition of blowing "to an extent to avoid material agitation of the bath by the oxygen stream" was derived from the processes of Schwarz, Miles and the work at Gerlafingen. Since we already know Gerlafingen experimented on the Schwarz patent instructions, we look only at Schwarz and Miles.

Both Schwarz and Miles advocated the introduction of the oxidizing agent or "heat-generating" elements into the interview of the bath. Both Schwarz and Miles require the chemical action to occur deeply within the bath. Schwarz instructs that in order "to cause the jet of gas to act within the liquid baths . . ." (DX5A, page 2 lines 11-12), the jet is to be directed "with such a high kinetic energy that it is capable of penetrating in the manner of a solid body deep into the bath by the use of extremely high velocities lying preferably above the speed of sound." (DX5A, page 2, lines 5-9). Miles evidently [193] attempted to improve upon Schwarz, but like Schwarz maintained that a high speed jet would be required to provide "optimum penetration . . . within the bath" (DX10A, page 3, lines 11-13, lines 17-19), suggested "the use of a liquid instead of a gas for the jet [because] the liquid has a greater force of penetration into the metal . . ." (DX10A, page 2, lines 13-16). And although Miles suggested using a liquid jet for greater penetration of the bath, Schwarz was not much different because he had also attempted to achieve the

same thing by inserting the jet with "such a high kinetic energy that it is capable of penetrating deep, in the manner of a solid body, into the liquid bath" (DX5A, page 5, lines 23-25, page 6, line 1).

Schwarz maintained that the danger of rapid wear of the container lining was eliminated because "local overheating and accumulation of ferrous oxide, takes place in the center of the steel bath and therefore the walls of the vessel are not substantially attacked." (DX5A, page 4, lines 24-25, page 5, lines 1-2). Miles said, "The high speed of the fluid jet has the effect that the source of chemical oxidation reaction is located within the bath . . ." (DX10A, page 3, lines 17-18). Schwarz said that by its method, it is possible . . . to cause the jet of gas to act within the liquid baths . . . (DX5A, page 2, lines 9-12). Miles said, "The fact that the reactions take place in the interior of the bath assures the use of the developed heat to the maximum degree." (DX10A, page 4, lines [194] 1-2).

Basically, then, both Miles and Schwarz sought to confine the chemical reaction resulting from the contact of the oxygen (and fuel) with the oxidizable matter in the molten bath and the high temperatures caused by such oxidation reaction within the interior of the bath (DX5A, page 4, lines 22-25, page 5, line 1; Miles, DX10A, page 3, lines 17-19).

Neither Schwarz nor Miles prevailed upon any operator of their processes to apply the jet vertically and at the center of the bath, but rather indicated an oblique application of the jet, or as in the case of Miles, by the use of a number of jets and "given a vibrating motion so as to cover a larger surface of the bath."[33] Development of

[33] This is altogether different from Seuss, which prescribes a "controlled" area of jet impingement "to produce a relatively confined zone of direct oxygen to molten metal contact with respect to the total surface area of the bath." (Col. 3, lines 46-49).

wide vari-shaped, uncontrolled areas for the high temperature oxidation reaction prevailed, not in concentrated form but wherever the jet struck and penetrated. While the aim of both Schwarz and Miles was to cause chemical reaction deeply within the interior of the bath, their instructions on the whole were not so directed. Nevertheless, the aims of both were to physically aid the frution of chemical actions. Although Schwarz did not say so, Miles did say that, "The penetration of the jet also fulfills the useful function of agitating the bath . . ." (DX10A, page 4, lines 4-6); [195] "The jet serves to maintain a vigorous agitation so that the oxidizing reactions follow . . ." (DX10A, page 10, lines 5-8); "The high speed jet causes a vigorous agitation . . ." (DX-10A, page 13, lines 11-13; and, "The jet serves to circulate and agitate the metal and the slag . . ." (DX-10A, page 18, lines 8-11).

No matter how good the intentions of both Schwarz and Miles to confine the oxidation reaction and the high temperatures *within* the interior of the bath, we have already learned (VII, Localized Reaction Zone, pages 144-166), that oxidation reaction will occur wherever the oxygen strikes or comes in collision (impingement in the Suess patent) with oxidizable matters in the bath, such as iron, silicon, manganese, carbon and other impurities and that chemical combination will occur there with the result of ignition and the formation of high temperatures. Furthermore, we have seen that if the oxygen jet is elongated, the oxidation reaction will occur, as in the case of deep penetration, from the place the oxygen strikes the surface down circumferentially about the jet to the deepest portion of the penetration, or as we have also learned in the depth of the indent. From this we may logically conclude that it would have been impossible for either Schwarz or Miles to have been capable of delimiting—localizing—the oxidation reaction within the interior of the bath.

The prior art taught that the physical application of the jet provided agitation or stirring action within the interior

of the bath in order to bring about chemical results. But the prior art failed in its aims and purposes of producing industrial steel, and at the same time failed to preserve the refractory [196] lining. The new art discovered what it believed was a scientific revelation which could be interferred with if the teachings of the prior art were permitted to apply. Thus it became the duty of the new art to differentiate any of the interferring or hindering factors of the prior art. *Flexwood Company* v. *Saussner & Co.*, 145 F.2d 528, C.A. 7, 1944.

The *McLouth* District Court found that "avoidance of deep penetration" could not be equated with "avoidance of material agitation" by its reasoning that in the first instance "avoidance of deep penetration" did not appear in the claims, and in the second instance that the phraseology "avoidance of material agitation" did not appear in the specification "in so many words." Because of its prior conclusion that avoidance of deep penetration was the gist of the invention, the *McLouth* District Court was demanding that either the literal words "avoidance of deep penetration" appear in the claim or, that the literal words "avoidance of material agitation" appear in the specification; and failing such appearances no amount of instructive and explanatory wording in the specification could compensate for the omissions.

However, assuming that such a finding was correct on the bare conclusion that no causal connection was shown "in so many words" (although as we have seen, there is an abundance of other words which do show causal connection, synonymity and partial interchangeability in the specification), it would seem inappropriate to upgrade judicial pronouncement over the special [197] expertise [11] of the

[11] The primary examiner had received a law degree, majored in electrical engineering and minored in chemistry. He had been employed by the General Electric Co. from 1924 to 1927 and had been in the patent office from January 1927. He became the primary

SUPREME COURT, U. S.

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IN THE

Supreme Court of the United States

OCTOBER TERM, 1974

No. 74-1555

KAISER INDUSTRIES CORPORATION, *et al., Petitioners*

v.

JONES & LAUGHLIN STEEL CORPORATION, *Respondent*

APPENDIX TO PETITION FOR A WRIT OF CERTIORARI TO THE UNITED STATES COURT OF APPEALS FOR THE THIRD CIRCUIT

VOLUME II—Pages 303-602

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Patent Office, who, after inquiry, found nothing wrong with the words "avoidance of deep penetration" except its negative character, and who, because of its aptness and differentiation from prior art, found greater appropriateness in the words "avoidance of material agitation." *Graham* v. *John Deere Co.*, 383 U.S. 1, 18 (1965); *Grimmell Corp.* v. *American Monorail Co.*, 285 F.Supp. 219, 223 (D.C.S.C., 1967). This would be true notwithstanding the fact that the courts have a superior right under the law to overrule the decisions of the patent office. *Hughes Tool Co.* v. *Williams*, 82 F.Supp. 408 (D.C. Okla., 1949) modified on other grounds, 186 F.2d 278 (C.A. 10, 1950).

It is regretable, I believe, that the LeRoy deposition had not been before the *McLouth* trial judge, since it might have clarified the difference between physical action induced by natural processes. It would also have differentiated the meanings of "agitation" as it appears in the claim and "agitation" as it is used in the specification, as well as the word "turbulence" as it is used on **[198]** the one occasion in the specification (Col. 6, line 69) when the patentees described the chemical exhaustion, "When the flame dies and carbon combustion is completed, the bath becomes relatively quiet and intimate contact between slag and metal bath ceases. The turbulence of the bath and slag due to the oxygen stream impinging from directly above is insufficient to cause continuance of oxygen-metal reactions." (Col. 6, lines 66-72).

The chemical action "turbulence" spoken of in the Opinion as being "agitation" is commented and ruled upon in the Opinion as follows:

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examiner of Division Three (Metallurgical Arts) on November 1953 and served there until November 1958. At the time he was deposed on January 8, 1970, he had retired from the top position which he had attained as Supervisor-Primary Examiner in the Patent Office. (J & L, PX 1002, pages 3-5).

> "This language is the sole reference in the specification of the patent to an *agitation of the bath by the jet.* In this reference, no mention is made of the depth of penetration. Certainly this reference does not expressly teach that only the avoidance of deep penetration results in the avoidance of material agitation of the bath by the oxygen stream. No causal relation between deep penetration and material agitation is taught." (Emphasis added) (257 F.Supp. at page 430).

It is obvious when looking at this reference, (Col. 6, lines 66-72) that the word "agitation" is not mentioned at all. It has nothing to do with deep penetration or even material agitation, but is simply an explanation of the fact that the "turbulence of the bath and slag due to the oxygen stream's impinging" ceases when the combustion has been completed. This was simply a verification that the oxygen jet physically contacts the metal in the bath causing ignition and visible flame within **[199]** the first minute of the blow, (Col. 4, lines 43-48), and when the chemical oxidation-reaction is completed, the physical action of the oxygen jet proves inconsequential.

Therefore, if this significance in the meaning of the word "agitation" in Claim 1 is being projected to the meaning of "turbulence," as just mentioned, it would very well be like mixing "kids," as children are sometimes called, with "kids," as relates to young goats. The word "turbulence as used by the patentees in this instance is somewhat, but not entirely, like the word "agitation" as used in describing the carbon FeO reaction forming carbon monoxide to cause "a strong boil or agitation of the bath, which auguments the bath circulation . . ." (Col. 4, lines 60-65). Since both the "turbulence" referred to in Col 6 and the "agitation" in Col. 4 are the results of chemical reaction, they are significantly similar, but dissimilar from the meaning of the word "agitation" in Claim 1, because its causative significance lies not in chemistry but in the mechanical functioning of the operator.

One of the rulings in the Opinion is that the "... plaintiffs have admitted that the specification does not expressly teach any such correlation" (avoidance of material agitation by the oxygen stream and avoidance of deep penetration). (257F.Supp. at page 430). I have followed through the examples presented in the Opinion and search the record for such admissions, but cannot arrive at a similar conclusion. **[200]** I am of the opinion that the *McLouth* District Court was searching for exact words. In a colloquy with the Court, the plaintiffs' counsel stated:

> "... where you avoid deep penetration you avoid this this material agitation of the bath by the oxygen stream."

The District Court replied:

> "Yes, that is what you say. That is true. But the specification *doesn't use that language* . . . It doesn't say that if you avoid deep penetration that material agitation would be avoided. *It doesn't say that in so many words.*" (Emphasis added) (PX-J-39 p. 13,329) (257 F.Supp. at page 430).

Again we observe that the District Court was looking for exact words when it observed that the terms "material agitation" or "avoidance of material agitation" were not stated in the specification.

> "The use of that language? You don't find it anywhere . . . Even the term 'deep penetration' is not associated in language with the term 'material agitation' as such. I mean you don't find the words 'agitation' and 'material agitation' . . . in the specification." (PX-J-39 pp. 13,327-13,328).

The District Court then concluded that it did not fall within the rule of law that each and every term used in a patent claim is not required to be set forth in the specification, because he said,

[201] ". . . here you have a phrase which, as I understand it, is almost the gist of the patent, or, at least, one of the very important elements, the avoidance of material agitation. And certainly you would agree, I think, that that must be taught." (PX-J-39 p. 13,328).

This conclusion arises from the District Court's conclusion that avoidance of deep penetration is the "gist" of the invention. Undoubtedly if this conclusion were true, one would expect the exact language to appear in the claims.

The plaintiffs' contentions are based upon what they allege are misconceptions by the District Court, all of which led to an immediate finding that "the concept of material agitation of the bath by the oxygen stream is purely fictional, since plaintiffs' own testimony strongly suggests that material agitation by the jet could not be achieved even with deep penetration." (257 F.Supp. at 432). The plaintiffs contend that there was no such testimony on the part of the plaintiffs' witnesses which could or should have persuaded the *McLouth* District Court into this thinking.

While it would seem that the *McLouth* District Court relied considerably upon what the experts might not have been able to find in "so many words" in the specification, it is incumbent upon me to rely less upon what the experts might or might not **[202]** have found in the specification, but rather what I, as the trial judge here may find.

I have particularly searched the record for the supports in the District Court Opinion that the "plaintiffs have admitted that the specification does not expressly teach any such correlation" (avoidance of material agitation by the oxygen stream and avoidance of deep penetration). (257 F.Supp. at page 430). I have followed through with the examples cited in the Opinion. The first is:

> "[COUNSEL FOR PLAINTIFFS]: • • • And then we have the teaching in regard to the avoidance of deep penetration.
>
> • • •

"And, of course, where you avoid deep penetration you avoid this material agitation of the bath by the oxygen stream.

"THE COURT: Yes, That is what you say. That is true. But the specification doesn't use that language.

"[COUNSEL FOR PLAINTIFFS]: That is correct.

"THE COURT: It doesn't say that if you avoid deep penetration that material agitation would be avoided. It doesn't say that in so many words.

"[COUNSEL FOR PLAINTIFFS]: That is correct, your Honor." (257 F.Supp. at page 430).

However, if the District Court had followed through with the recording of the colloquy, it would have been apparent that counsel for the plaintiffs was attempting to distinguish the "agitation" caused by the jet from the prior art. The colloquy **[203]** continued (PX-J-39, pp 13,329-13,330, 13,332-13,333).

"MR. WILLIAM WEBB: That is correct, your Honor. But I think you must remember also that the prior art teaching is to *agitate* the bath by deeply penetrating into the bath . . .

THE COURT: Would deep penetration necessarily cause material agitation, excessive agitation? Does that necessarily follow?

MR. WILLIAM WEBB: I believe so. I think that that is the effect of it.

THE COURT: Does the testimony show that now? . . .

MR. WILLIAM WEBB: Yes, your Honor. I am sure that both— . . .

THE COURT: Then if there is in fact the deep penetration, like under Schwarz and Miles, or, as you claim, under Durrer and Hellbruegge—if there is in fact deep penetration, does the *agitation of the bath caused by deep penetration overcome the circulation caused by the chemical reactions?* . . .

> MR. WILLIAM WEBB: . . . I don't believe its covered by the evidence.
>
> But I am sure of one thing, and that is that the patents themselves which give this teaching of deep penetration expressly point out that what they are doing and what they are seeking to accomplish is the *stirring of the bath by the oxygen stream.* The Miles patent makes that very clear. So that is what the object was of penetrating the gas deeply into the bath." (Emphasis added)

Here we see the construction by which the District Court gave the words "agitation" and "circulation" identity of meaning, and then juxtaposed them interchangeably as actions in a bath caused by deep penetration and as circulation or action in a bath caused by chemical reaction. And so it found it difficult to understand how these two identical actions could be **[204]** in conflict with each other, whether caused by deep penetration or chemical reaction.

The plaintiffs' counsel was attempting to explain the significance in the physical sense as it differentiates the use of the word "agitation" in the Suess claim from the physical, positive action which is described in prior art and thus consistently within the meaning of "avoidance of material agitation." This furthered the obligation of the applicants to differentiate their teaching from the prior art method of deep penetration. Under Section 112 this was a required showing between the instant application for a patent and the prior art. *Flexwood Co.* v. *Saussner & Co.*, 145 F.2d 528, C.A. 7, 1944.

A second example cites Dr. Elliott's testimony. The District Court said, "According to Dr. Elliott's testimony (R. 6638-6642), the specification of the patent in suit teaches the correlation between the avoidance of deep penetration and the avoidance of material agitation at six different places."[34] The Opinion refers to these separately

[34] This testimony appears at PX-J-20, pp. 6638-6642.

and makes a conclusion that "Agitation of the bath by the jet is not mentioned" in one way or another, but that in any event "none of the references relied on by the plaintiffs teach any causal relation between deep penetration and material agitation by the oxygen stream." (257 F.Supp. at pages 430-431). References to which **[205]** the Opinion alludes are col. 3, lines 37-50; col. 4, lines 26-38; col. 6, lines 69-73; col. 4, lines 54-67; col. 9, lines 6-14; and col. 10, example No. 1.

My study of Dr. Elliott's testimony in this connection, both direct and cross, does not disclose any specific place where he took these six references and analyzed them. Rather, he accepted the instructions contained in the specification, particularly of blowing vertically and centrally, so as to avoid material agitation (PX-J-19 p. 6166). He said that the operator knows when he is avoiding material agitation when he (1) controls the slag; (2) does not unduly damage the refractories, and (3) has proper control of the bath composition (PX-J-19 p. 6167). He cited the same three factors in regard to avoidance of deep penetration (PX-J-19 p. 6169). We see that using the references given in the pages under study, with the exception of col. 6, lines 63-73, Dr. Elliott rather emphasized the local reaction zone, directly or indirectly, through example, and so in effect taught the importance of vertical and central placement. Defense counsel's cross examination of Dr. Eliott dealt most heavily with this phase rather than a direct correlation of "avoidance of deep penetration" to "avoidance of material agitation" (PX-J-20 p. 6410).

The sixth reference dealt with the quieting of the bath at the end of the decarbonization, when the reference said "the turbulence of the bath and slag due to the oxygen stream **[206]** impinging from directly above is insufficient to cause continuance of oxygen-metal reactions." Presumably this is done to show that there can be no material agitation by the oxygen jet when and where oxidation reaction processes are not active.

In all of this Dr. Elliott was explaining a relation to the instructions contained in the specification of how and when the oxygen jet can be used with unwanted physical agitation, and how and when such unwanted physical agitation by the oxygen jet would occur under certain circumstances. At one place he said (PX-J-20 p. 6633):

> "A. Well, I look at the statement in the patent with regard to lance arrangement. I analyze in my own mind the way that jets behave. And this combination of information brings out the fact that this is the way you get the least possible action of the jet."

Then again he said (PX-J-20 p. 6637):

> ". . . I believe that one skilled in the art, reading the patent, would call on those things which I discussed earlier with regard to refractory life, control of the localized reaction zone specifically. This is quite specific in the examples in the patent and in the specific statements of the patent with regard to phosphorus control, and this would convey a very clear picture of the problems arising when there was deep penetration."

He also said (PX-J-20 p. 6638):

> "When one is seeking to agitate the bath by mechanical action of the jet, he must engage the bath with the gas stream. This can be done only as the gas stream enters deeply into the bath if one wants to do it effectively. Hence there is a direct relationship between these two terms deep penetration and material agitation."

[207] Dr. Elliott substantially repeated the same testimony here. (See CE p. 252).

One reason the District Court asserted for its insistence on specific language was that with the language presented ". . . persons skilled in the art of steelmaking reading the patent are not informed of the meaning of the language in the claim referring to the avoidance of material agitation by the oxygen stream." (257 F.Supp. at page 431). This holding, however, is in conflict with the District Court's

holdings that with the admissions of the defendant's employees,

> "In sum, this Court finds that the specification of the patent in suit, despite certain indefiniteness and inaccuracies, nevertheless complies with Section 112 by disclosing the invention in sufficiently clear terms to enable steelmakers 'to make and use the same.' " (257 F.Supp. at page 424).

Additionally, the difficulty with this excerpt (257 F.Supp. at page 431) is that considering the first two sentences if "the concept of the avoidance of material agitation of the bath by the jet would not have been meaningful to persons skilled in the art at the time the invention was made," or if Schwarz and Miles patents did not mention the concept of material agitation, and if either Miles or Schwarz patents had taught any causal relation between deep penetration and material agitation, they would have anticipated the Suess patent and it would have been obvious and nonpatentable.

But the District Court held, "In other words the Court finds that the patent in suit is not anticipated by [208] the prior art." (257 F.Supp. at page 395). And further, such material agitation "would certainly not have been obvious to steelmakers in 1950 . . ." (257 F.Supp. at page 404) Likewise, Dr. Chipman on cross-examination by counsel for the defendant (commencing with PX-J-4 p. 888A) was asked about the physical force of the jet being limited in order that the agitation of the bath not become material. He replied (PX-J-4 p. 889) that the word "material" had to be used in context. He explained that there were other sources of agitation than the deep penetration. However, when the questioning was resumed on the point, he elaborated on his statement and said (PX-J-4 p. 1066):

> "If you wanted to encourage agitation of the bath by the oxygen stream . . . you would not blow vertically downward in the center of the bath. You would blow

at an angle and somewhat off center, and this would give your bath the material agitation."

Dr. Chipman perhaps presented a clearer picture of physical agitation (PX-J-4 pp. 889-900A), all of which was concisely summarized in the plaintiffs' main brief at McLouth (PX-K-1 p. 192) in the following words:

". . . that the agitation by the oxygen stream becomes material and, hence, objectionable when it *interferes* with the bath motion caused by chemical reactions, or when it causes significant refractory damage, or when it *interferes* with the **[209]** proper formation and composition of the slag as a result of the deep penetration required to create the agitation." (Emphasis added)

Dr. Chipman summarized the "how to do it" by replying (PX-J-4 p. 1064) that by following the specific teachings of the patent . . . as regards lance height, size of heat, pressure, flow rate, nozzle to bath distance" anyone skilled in the art would not have any difficulty in blowing in such a way as to avoid material agitation of the bath. He said (PX-J-4 p. 1067) that if you followed the specific teachings of the patent you would avoid material agitation of the bath by the oxygen stream. Nevertheless, the *McLouth* District Court held

"Thus this Court concludes that the claim step of avoidance of material agitation of the bath by the oxygen stream is not supported by the specification of the patent in suit except in a very limited and perhaps meaningless way, and could not have been a meaningful concept to persons skilled in the art at the time the invention was made, especially since the concept did not appear very meaningful to some of plaintiffs' expert witnesses even at the trial roughly fourteen years later.

This Court is further persuaded on the basis of plaintiffs' own testimony that the concept of material agitation of the bath by the oxygen stream is purely fictional . . ." (257 F.Supp. at page 432)

Here, again, we are reminded that the Opinion contained several rulings to the effect that persons skilled in the art **[210]** of steelmaking could use, make and perform the Suess et al. process in accordance with the instructions as were given in the patent.

The conclusion that "avoidance of material agitation" "could not have been a meaningful concept to persons skilled in the art at the time the invention was made," is contradicted in the Opinion itself:

> First, "In sum, this Court finds that the specification of the patent in suit, despite certain indefiniteness and inaccuracies, nevertheless complies with Section 112 by disclosing the invention in sufficiently clear terms to enable steelmakers 'to make and use the same.'" (257 F.Supp. at page 424)
>
> And second, "The substantial advantages of the Linz oxygen blowing process of steelmaking quickly became apparent . . .
>
> The reaction of steelmakers to the Linz process was one of initial skepticism followed by recognition of the invention and adoption of the process. The remarkable success of the Linz process is dramatically illustrated by the fact that no open hearth furnace has been built in this country since 1943, when knowledge of the Linz process became available in this country." (257 F.Supp. at pages 398-399)

And yet the Opinion does not find complete absence of causal connection between "the avoidance of deep penetration **[211]** and the existence of the features of the patent claims, including a localized reaction zone, the avoidance of material agitation of the bath and a circulation caused by chemical reactions." (257 F.Supp. at page 403)

The Court conceded that, "it is true that the Rinesch and Hauttmann affidavits in 1957 attributed a causal con-

nection." However, the District Court disregarded these for the reason that ". . . it is a serious question whether persons skilled in the art of steelmaking in 1950 would have understood the features of the claims of the patent in suit as depending upon avoidance of deep penetration for their existence. In other words, it is questionable whether the claims of the patent in suit have any clear connection with what appears to this Court to be the actual invention by the patentees." (257 F.Supp. at page 403)

Thus, if it is true that what appeared to the District Court to be the actual invention by the patentees was "avoidance of deep penetration" as "the gist of the invention" it might very well have been necessary that more emphatic words than "to such an extent as to avoid material agitation of the bath by the oxygen stream" appear in the claims. For the failure by the applicants to have provided more suitable words, **[212]** the patent efforts of the applicants might indeed be subject to failure. However, if the testimony of the witnesses at the first post-trial hearing before me on the file wrapper estoppel issue is entitled to any weight and credibility, then the patentees provided suitable words to describe their advance.

[213] **XI. 3000-8000 to 1**

The McLouth District Court Opinion states that,

> "This Court is further persuaded on the basis of plaintiffs' own testimony that the concept of material agitation of the bath by the oxygen stream is purely fictional, since plaintiffs' own testimony strongly suggests that material agitation by the jet could not be achieved even with deep penetration." (257 F.Supp. at page 432)

This conclusion is to a large extent based on the testimony of Dr. Ascher H. Shapiro, a professor of Mechanical Engineering at Massachusetts Institute of Technology and a plaintiffs' witness. Dr. Shapiro testified that the force of

chemical reactions in the bath would be "roughly 3,000 times stronger than the force of the jet blowing vertically from above . . ." (257 F.Supp. at page 432, R. 3772-3773). The Court then concluded "In view of the tremendous force of chemical reactions agitating the bath and initiating a circulation downward in the center of the bath as compared with the relatively feeble agitating power of the jet, it seems impossible that a deep penetration by the jet could overcome or even materially affect such circulation, so as to cause a material agitation by the oxygen stream." (257 F.Supp. at page 432).

The Court thereafter referred to certain testimony of Dr. Elliott indicating that the physical force of the jet was indeed very small, in comparison to the overwhelming force of the oxygen action. Therefore, the *McLouth* District Court **[214]** wanted to know how there could be any "material agitation of the bath by the oxygen stream" which could possibly interfere with a force that was 3,000 times stronger than the physical force of the jet.

From my full inquiry and study of the record of the case, the answer to the question thus posed becomes apparent.

The District Court extracted this question from the testimony of Dr. Shapiro, who was a specialist in the field of thermodynamics, fluid dynamics and power production. He presented evidence for the purpose of proving what caused the circulation in the bath. This part of the transcript of testimony comprised 2,293 pages with a myriad number of demonstrations, movies, charts and diagrams, as well as calculations with explanations of the cause and effect of mechanical and chemical reactions and interactions.

From his many demonstrations and from his own expertise, Dr. Shapiro concluded that circulation in the molten bath was the end result caused by the particular dynamics of the bath, whether fluid, chemical or kinetic. I have carefully examined and questioned the evidence which

he presented and have endeavored to relate it to the context of the Suess et al. specification. So far as his testimony was concerned as it related to the units of force on the molten surface of the bath, the end result of his testimony was that

[215] "... the force with which the mechanical action of the jet is capable of applying to a melt of some 200,000 pounds of weight, is only about 6.6 or six and a half pounds." (PX-J-12, p. 3740)

He said that the 6½ pounds is the total frictional force applied tangentially to the surface, and that the downward force was in the neighborhood of 350 pounds which could only produce an indent, and could not produce motion in the bath. Therefore there could be no circulation produced by the physical force of the jet inside the bath, and this was the purpose of his testimony.

In explaining what did cause the circulation in the bath, he arrived at two parallel calculations, one of force and one of power. By a series of calculations he demonstrated that the force resulting from the chemical action which provides circulation in the bath, is over 3,000 times as great as the frictional force available from the jet itself (PX-J-12, p. 3756-3773). However, as relates to power, he demonstrated how the calculation should be made, and concluded that the power applied to the circulation of the bath *from chemical origin* is 8,200 times as large as the power applied to the bath by mechanical action of the jet (PX-J-12, p. 3774-3801). He made no mention whatsoever of any relationship between the causes of the circulation and any potential application of the jet as an agitation of the bath. This evidence opposed that of the McLouth experts who attempted to show that the [216] circulation was physically produced by the jet only, and that it was upward in the center, because so induced by the physical action of the jet.

From this part of the examination of Dr. Shapiro's testimony it is obvious that its content relates to the proportionate force or power which creates the circulation in the molten bath in accordance with the belief of the Suess patentees. The ultimate conclusion presented is that only chemical action can produce such circulation in the bath and so supports the references in the patent specification. Stated differently, the evidence of Dr. Shapiro was submitted for the purpose of showing that the oxygen jet had no physical potential for producing circulation in the bath, despite McLouth's attempt through its experts to show that the circulation, if any, was produced by the jet action only and that it was upward in the center because it was mechanically produced.

With this limited understanding of the substance of Dr. Shapiro's testimony, we now look at the specification, particularly, col. 4, lines 43-60, which describes the change taking place when the oxygen combines with the iron and forms the oxides. Oxygen in combination with other elements has already begun its chemical combination-oxidation-reaction function. Its physical force in the jet no longer prevails. Its chemistry generating power does. We saw this proved in the [217] ladle-rudder exhibitions at Linz, Austria (PX-36C, 36-D, PX-161, PX-185A) when the oxygen was turned on and off. As it was applied the oxidation-combination-conversion started; when the oxygen was turned off, it stopped. When turned on again, the oxidation-combination-conversion action resumed.

Thus, we see two forces in their respective realms in a "before-and-after" marriage symbol by which both become atomically united. Comparably we see the ordinary household match, innocuous, as it lays quietly undisturbed, but when friction is applied (heat applied) in the presence of oxygen, it bursts into flame. But the oxygen which is consumed from the air is an infinitessimal quantity compared to the flame to whose generation it gave itself. So it is in the molten metal bath, when the oxygen impinges on

the molten metal bath, most of the oxygen in the jet becomes chemically converted and itself is consumed.

The answer then to the 3000-8000 to 1 question raised in the Opinion is that the 3000-8000 units of force are altogether the chemical reaction of oxidation-combination reaction which are engendered, propagated and produced by the one unit of oxygen force, whereupon it combines or dissolves, or in any event disappears into, and becomes a part of the resulting chemical reactions. Thus it is quite obvious that one unit of force or power of the oxygen jet does not overcome or conflict with the 3000-8000 unit of chemical force or power of which it naturally is a part and for which together they have become a synchronism.

[218] **XII. Agitation v. Agitation**

If the scientific answer to the question of how a 1 unit of force-power could overcome a 3000-8000 unit of force-power, is that it cannot and does not, but that rather they become combined or integrated, then the next question is why did that problem confront the District Court? I am convinced that this occurred because a great deal of confusion surrounded the word "agitation."

The term "to agitate" means[34] (1) to move with a violent or irregular action, to set or keep in motion; (2) to stir up or excite; to perturb. The word "agitation" means either the act of agitating or the state of being agitated. Thus this word may have either an active or passive significance. As already stated, the word "agitation" appears only twice in the patent: once in the specification where it is used as a result of a chemical reaction which in turn becomes the chemical causative factor of another chemical reaction; and once where it is used in the claim in its physically resultant significance.

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[34] Webster's Third New International Dictionary, 1971 at page 42.

A number of statements in the Opinion inject a conflict of thinking between the physical oxygen jet itself, and the chemical [219] reactions which the oxygen jet generates. Certain references in the Opinion relate the word "agitation" in the Claim in the same way as does the prior art of producing chemical turbulence by injecting the oxygen jet within the interior of the bath. Thus, a conflict is formalized between the significance of the "avoidance of material agitation" and "avoidance of deep penetration."

In a large measure I am convinced that much of this misunderstanding of the significance of the word "agitation" occurred because the plaintiffs' experts failed to adequately explain both the factual and scientific factors involved. As one instance, we see in considerable parts of the *McLouth* transcript, that invariably the plaintiffs' expert witnesses and even sometimes counsel for the plaintiffs, loosely used the word "agitation" in such a way as it was not used in the patent, or failed at times to make it clear.

In other words, it was used interchangeably and indiscriminately in pointing out physical causation as signified in the words of Claim 1 and of resultant action, "motion" or "circulation" as signifying "turbulence" produced in the molten bath by whatever causes. When we realize how haphazardly even the [220] experts were in referring to these various terms, and especially to the word "agitation," and when we begin to read and re-read first of all the specification and then the testimony of the witnesses, we begin to understand that this could have been the cause of much confusion in the handling of the ideas which the patentees intended to convey to experts in steelmaking.

Observing with what interchangeability the words were used, we recognize, as we view the specification, with what exclusivity the patentees chose certain words or phrases such as "impinge," "surface," "reaction," "high temperature" and similar other words; that they used the word

"agitation" in the claim once and in the specification only once; that they did not use the word "turbulence" in the claim and used it only once in the specification; however, that the word "circulation" was employed on a number of occasions.

It will be observed that each word or phrase characterizes its own setting, and when all are pictured as a whole, the steelmaker or one expert in the art of steelmaking is given a panoramic understanding of what prior art was, what the objects of the patentees are, what the process is, what instructions enable any person skilled in the art to make and use the same, examples on **[221]** how it is to be done and finally, the scope of the invention and the claim of what the subject matter is which the applicants regard as their invention.

In the context in which the word is used in the claim, it is significant that it is used in a negative or cautionary sense of not actuating, provoking, stirring or prodding into action. Thus by the words which surround it in the claim, the word "agitation" relates to limiting or preventive activation or stirring of the bath by the oxygen stream. The meaning becomes quite obvious if we hypothetically and experimentally substitute the word "stirring" for the word "agitation" in the claim. It is not my prerogative to prescribe what words the patentees should have used because they are their own lexicographers. *Application of Rohrbacker,* 284 F.2d 531, C.A.P.A. 1960. However, it must be for me at this time to reasonably interpret these words. *Canaan Products Co. Inc.* v. *Edward Don & Co.,* 388 F.2d 540, C.A. 7, 1968.

Although the District Court asserted that the word "agitation" was added to the claim in the Patent Office as "an obvious attempt to distinguish the Miles patent" (257 F.Supp. at pages 431, 435), no blame may be attached to the patentees for so doing, **[222]** since the law requires it. In determining the validity of a patent, the scope and con-

tent of prior art must be examined, differences, if any, between the prior art and the claims at issue ascertained and a resolution made of the level of ordinary skill in the pertinent art. *Eagle Iron Works* v. *McLanahan Corp.*, 429 F.2d 1375, C.A. 3, 1970; *Rains* v. *Cascade Industries, Inc.*, 402 F.2d 241, C.A. 3, 1968; *Gould-National Batteries, Inc.* v. *Gulton Industries, Inc.*, 361 F.2d 912, C.A. 3, 1966.

The looseness with which the word "agitation" was used by counsel was noticeable when Dr. Hauttmann was speaking through an interpreter, and this very problem arose. The Court said (PX-J-8 p. 2410):

> "Better repeat that so that he will understand.
>
> "Dr. Alle [the interpreter]: I think we have a distinction here between 'movement' and 'agitation,' and both words have the same meaning in German, and that is the difficulty."

The defendant's witnesses used it indiscriminately during the trial of the case, and an example of such use was the statement by the defendant's superintendent, Lindberg, relating to the first ten minutes or so of a blow, as follows (PX-J-12 p. 3567-3568):

[223] "A. The reaction or agitation is very, very severe at that time."

The District Court made a reference where it, collaterally and unintentionally showed that Dr. Chipman used the word "agitation" loosely. As for instance, it quoted Dr. Chipman as follows:

> "The teaching that I find in the patent with respect to agitation leads me to conclude and understand that the *agitation* which is present in actuality is far greater than the agitation by the oxygen stream, compared to which the agitation of the oxygen stream becomes immaterial." (PX-J-4 p. 880) (257 F. Supp. at page 433). (Emphasis added).

Here we see the word "agitation" as the chemical action or turbulence as against the *agitation* as the result of the oxygen stream.[35]

Dr. Chipman also verified what the defendant's witness Lindberg said about the chemical action at the place of impingement when he was asked why they should bother with material agitation. He replied (PX-J-4 p. 900):

> "A. Because there is a great deal of *chemical agitation* produced." (Emphasis added).

Dr. Chipman was asked on another occasion that (PX-J-4 p. 1067):

[224] "Q. . . . if you followed the specific teachings of the patent, would you avoid material agitation of the bath by the oxygen stream?

A. Yes, I think you would."

because then such agitation caused by the jet would be insufficient to advantageously affect or change the *"agitation"* or *"movement"* of the bath by the *chemical reactions.*

Dr. Shapiro in speaking of the high temperature zone said (PX-J-12 p. 3845):

> ". . . there is a tremendous degree of agitation in this neighborhood *brought about by the chemical* reactions." (Emphasis added).

Also, when he explained the rudder demonstration conducted in June, 1963 at Linz, Austria, he described the variabilities of the rudders by the word "flutter" and said (PX-J-12 p. 3858-A):

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[35] Incidentally, this statement by Dr. Chipman reveals that the oxygen stream agitation "becomes immaterial" as I point out in No. XI "3000-8000 to 1," where the one unit of oxygen stream force-power becomes absorbed and integrated into the 3000-8000 units of force-power which it creates by its chemical reaction-combination.

"... That flutter, I believe, is due to the general turbulence and agitation which exists in the bath."

And at (PX-J-12 p. 3859):

"It is due to the kind of *turbulence* and *agitation* which one could see in the oxy-acetylene explosion demonstration." (Emphasis added).

Even Dr. Elliott was careless about the precision with which he used the word "agitation" and confused it with "action" when he was asked about the chemical reactions occurring in the hot spot or the localized reaction zone (PX-J-19 p. 6275), and he said (PX-J-19 p. 6276):

[225] "They [chemical reactions] occur extremely rapidly. . . . There is considerable *agitation* action, when this occurs." (Emphasis added).

He later said that (PX-J-19 p. 6278):

"... when the end point arrives and the chemical action diminishes greatly, the *agitation*, the *action* in the system diminishes greatly as well." (Emphasis added).

The District Court on a number of occasions used the word "agitation" interchangeably with action, circulation or turbulence in the bath, but it was most significantly used in the Opinion when Ann Arbor Demonstration No. 7 was being discussed.[36] I need cite only one or two references to make the point. As for instance, the Opinion speaks of "... the tremendous force of chemical reactions 'agitating' the bath ...", and a comparison was made "with the relatively feeble agitating power of the jet ..." (257 F. Supp. at page 432). Second, and more noticeably, interchange of the word "agitation" was used in the Opinion in connection with the discussion of Demonstration No. 7 at Ann Arbor, Michigan, which was cited in the Opinion

[36] These demonstrations are discussed under XIII.

for the purpose of showing that deep penetration did not produce "material agitation"—although I discuss this elsewhere [37] and refer to the fact that these demonstrations were not offered [226] by the defendant as any proof relating to "material agitation".

The conclusion made in the Opinion was: "In effect, the specification of the patent in suit presented a new theory of *agitation caused by chemical reactions,* and the claims referred to an avoidance of agitation by the jet to give the impression of an entirely new steelmaking process." (Emphasis added). (257 F. Supp. at page 435). Had the District Court used the word "circulation" instead of the word "agitation" at the first place as caused by chemical reactions, it would have been correct since the foundation upon which the Suess concept rests is in the procurement of chemical circulation as against the elimination of physical jet agitation. Thus the District Court used the word "agitation" as a substitute for the word "circulation" and it then used the word "agitation" in the second place by the jet as "an entirely new steelmaking process". If it had here used the word "stirring" by the jet, it would have again been correct as signifying the meaning of the word "agitation" in the claim. Therefore, it would seem that the Opinion misapprehended and interchanged the thought contained in the specification with that part of the claim which used the word "agitation" and related it to chemical reactions when the only thinking that the specification and claim indicated was that it is a physical function for the operator, a chemical [227] reaction thereafter, and an appropriate reference to the subject matter in Claim 1 of discharging the stream of oxygen within the limits defined in Claim 2 and in the specification.

This same thinking prevailed in the Opinion when it spoke of agitation of the bath relating to Demonstration

[37] These demonstrations are discussed under XIII.

No. 7, ". . . large amounts of slag and metal were thrown up and out of the converter onto the floor, indicating a violent agitation of the metal bath." (257 F.Supp. at page 433). Also, the term "throw-out" was used interchangeably with the word "agitation" as follows: "In other words, the 'agitation' of the bath as shown by the throw-out subsided . . ." (Emphasis added). (257 F. Supp. at page 434).

It is made more significant by the following excerpt:

> "If the bath *agitation* causing such *throw-out* of metal and slag had been caused by the mechanical action of the oxygen stream alone, the *throw-out* would not have ceased as it did near the end of the blow. It is obvious, therefore, that the *action* of the oxygen stream alone was not responsible for the *agitation* of the bath causing *throw-out* of metal and slag during the major part of the blow." (257 F. Supp. at page 434). (Emphasis added).

I have indicated elsewhere [28] that because the activity within the bath during the functioning of the process could not be visibly distinguished or sensed from the "stirring" function by the operator, there was confusion as to [228] both and a misconception of their differences.

If then there is no conflict between the 1 unit of physical force or power and the 3000-8000 units of physical force or power, why then were the words "to such an extent as to avoid material agitation" put in the claim by the applicants? All of that was explained by primary examiner LeRoy and Byron T. Gardner, Attorney in charge of the prosecution of the patent who testified at the first post-trial hearing as to what occurred in the Patent Office on May 1, 1957. LeRoy thought

> "that the language should try to bring out that the oxygen stream was confined or localized in the area

[28] Compendium VI.

somewhere near the surface of the bath." (PX-1002 p. 8).

The deep penetration he thought was well known in the art, but if you wanted to define a special penetration into the bath, he suggested that they use something to show it was localized in that area (PX-1002 p. 8):

> "It was well understood in the art that deep penetration meant a considerable distance into the bath and they wanted to avoid that concept . . . so the language that [they] finally adopted there was to bring out that feature." (PX-1002 p. 9, 10).

The primary examiner believed "that the definition in the language finally adopted adequately describe[d] the essential distinction over the art of record." (PX-1002 p. 12). He [229] also looked at "All of the art of record." (PX-1002 p. 20).

Mr. Gardner pointed out (FWE, p. 17-18) that a physical distribution of the oxygen throughout the molten metal as in the case of Miles was supposed to produce great physical turbulence and a very complete reaction and purification of the bath. As a practical matter it didn't work that way. The "mixing" or "agitation" of the bath by the oxygen stream developed very high temperatures throughout the bath with bad results. Suess applicants wanted to avoid this, and pointed out that their process "created a localized area of intense heat and reaction between the oxygen and carbon, silicon and other heat producing materials . . ." Thus Miles' mixing or agitation was to be avoided or prevented by Suess in order to provide for a localized reaction zone where chemistry would take over. Thus it seems that the word "agitation" in the claim as considered by the Patent Office and by the patentees as of the time of the processing of the patent was recognized in the sense of a limited or localized action by the jet. The reasons for this were obvious. If penetration

was too superficial slopping occurred. (PX-J-21 p. 7120-21), (PX-J-26 p. 8781). If penetration was too deep, it would interfere with the chemistry defined by Suess. If it was angular, or off-center, it would provide (whether [230] deeply blown or not) the stirring action indulged in by the prior art. (PX-J-3, p. 594-597, PX-J-4, p. 882, 1066, PX-J-19 p. 6165-66). Dr. Rinesch in the affidavit filed with the continuation-in-part application (PX-2A p. 83) said that deep penetration:

> "... creates an uncontrollable turbulence in the bath. The oxygen remains dissolved in the bath and the high oxygen content in the final steel leads to hot shortness or requires unsatisfactory quantities of de-oxidizers. Furthermore, the phosphorus cannot be slagged off. Moreover, the walls, and particularly the bottom of the vessel become as hot as the reaction center and, therefore, are eroded severely."

Dr. Hauttmann in his affidavit filed with the continuation-in-part application (PX-2A pp. 90-91) said:

> "... that an essential characteristic of our method is that a limited center of reaction is created in the bath by blowing oxygen onto the surface through a nozzle which is placed at a considerable vertical distance from said surface, said center of reaction being spaced laterally from the side walls and vertically above the bottom wall substantially in the surface layer and *that agitation such as is caused by the deep penetration of the jet according to the methods of the prior art,* together with injury to the lining, and interference with the refining action thereby are avoided ..." (Emphasis added).

He also said (PX-2A p. 91):

> "Another difference between the method discovered by us and the prior method is that the force of the oxygen jet vertically impinging on the bath surface is controlled to avoid uncontrolled *agitation or stirring* of the bath ..." (Emphasis [231] added).

He said (PX-2A p. 92):

> ". . . our concept of securing purification of the entire contents of the bath mainly by the controlled circulation induced by the reaction center is just the opposite of trying to carry the oxygen to all parts of the bath by *agitation* produced by deep penetration, as by the methods disclosed in the Schwarz and Miles patents . . ." (Emphasis added).

Coinciding with the unwillingness of the District Court to accept "material agitation" in its physical sense as being differentiated from the prior art, it was unwilling to accept Dr. Elliott's statement that deep penetration agitated the bath, because it said that ". . . the meaning of material agitation would still not be adequately clarified, since even the concept of deep penetration does not acquire a clear or consistent meaning from Dr. Elliott's testimony." (257 F.Supp. at page 435). The Court then went on to say that because Dr. Elliott said that deep penetration both causes an up in the center circulation "which may cause refractory wear on the walls near the bath surface" and also "causes bottom damage to the refractory (R. 6166) as the result of a downward moving stream of hot metal in the center of the bath", that in effect Dr. Elliott's testimony was incredible because, "Clearly, circulation cannot be both up and down in the center at the same time." (257 F. Supp. at page **[232]** 435)

Since I have inquired into the scientific facts there involved, I discuss it more detailedly at the chapter entitled *Up And Down At The Same Time,* and accordingly assert that the cited basis for a lack of credibility of Dr. Elliott is unwarranted.

Thus, taken from the wording of the specification and from the evidence of record at *McLouth,* as well as the Patent Office witnesses of record here in the first post-trial hearing, the word "agitation" as contained in the claim is not fictional, but does have substantial significance to

the person skilled in the art of steelmaking to abide by the instructions contained in the specification and not to employ the oxygen jet physically as was the custom in the prior art. The fact that the applicants put the words "to such an extent as to avoid material agitation by the oxygen stream" to distinguish the Suess et al. patent from the prior art and to caution the persons expert in the art of steelmaking against doing what the prior art did physically, was a logical and valid act, and such terminology should not be negated.

[233] XIII. Defendant's Ann Arbor Demonstrations

In its Opinion, the District Court discredited Dr. Elliott's testimony and held there is, moreover, "tangible evidence in the record tending to confirm that the concept of material agitation by the oxygen stream is a fiction" (257 F.Supp. at page 433).

This conclusion was based upon the results of three in a series of five tests conducted by the defendants' experts at Ann Arbor, Michigan.

The Ann Arbor demonstrations were conducted on May 15, 19 and 21, 1964 and were admitted for the purpose of showing the effect upon steelmaking and steelmaking equipment of varying depths of penetration, and to provide a method for measuring penetration. (McLouth Main Brief After Hearing, PX-K-4 at page 90).

[234] Preliminarily, the Ann Arbor Demonstrations which concern us here were carried out in a 15 inch vessel.

1. With a charge of metal of approximately 270 pounds;
2. With equal flux conditions;
3. With a lance height of 7 inches, except for a 25 inch height in Demonstration No. 6;
4. With a starting bath temperature of between 2500° F — 2800° F;

5. With a bath depth of approximately 6.6 inches—6.8 inches; and

6. With a lance nozzle diameter of .316.

Later, I shall compare these conditions with those prescribed by the Suess patent, and shall further compare the results promised by each.

[235] Preliminary, and in short summary:

Demonstration No. 5 (McLouth DX-160) (PX-K-12-B p. 1863b) (PX-J-21 p. 7104-7118) was evidently designed to show that an oxygen jet blowing from a height of 7 inches and 20 psig penetrates at least to the center of the 6.6 inch metal bath.

Demonstration No. 7 (DX-280, PX-J-21 pp. 7127, 7137-7141) was designed to show that with a lance 7 inches above the bath, after two minutes of oxygen supplied at the rate of 20 psig to create a fluid slag, when the pressure was increased to 40 psig, and continued until the carbon end point, that such deep penetration would make a depression in the bottom of the vessel, while at the same time *ductile* steel was produced.

Demonstration No. 9 (PX-J-22 pp. 7285-7294) was designed to show that a brick in which a hole had been bored would be penetrated by raising the pressure from 20 psig to 40 psig, and that the oxygen jet would come through the hole, but that when the pressure was returned to the 20 psig, molten liquid would flow through the hole. Thus it presented evidence purporting to show that it was the oxygen jet which burned the hole through the refractory brick in Demonstration No. 9 and not the molten metal.

Demonstration No. 6 was conducted for the purpose of showing that the superficial application of the oxygen jet on the bath surface produced "a bad slopping condition and ineffectual operation." (PX-J-26 p. 8781).

Demonstration No. 8, which was conducted on a flat plate, **[236]** was not considered in the Opinion. However, it is

Demonstration No. 9 which received critical focus in the Opinion. In particular as it pointed up, isolated, and evaluated the credibility of Dr. Elliott's estimony.

Demonstration No. 9 was intended (PX-J-22 p. 7285):

> "... to show that the bottom marking of the converter is caused by the oxygen jet penetrating completely through the bath and not by a sinking column of hot metal."

The same conditions in the bath were used for Demonstration No. 9 as in the case of No. 5, except first that the bottom brick refractory had a hole partially drilled into it, leaving a thickness of 15/16ths of an inch from the bottom; and second, this demonstration started with an oxygen pressure of 20 psig and was raised after two minutes to 40 psig. The result was that fifty seconds later, the "flaming jet" could be seen "issuing beneath the bottom." The "flame" came through for about ten seconds until the pressure was cut back to 10 psig. (PX-J-22 pp. 7290-7292).

Dr. Flinn's recollection was as follows (PX-J-22 p. 7367):

> "But as I recall, after we had been at 40 psig, the pressure necessary to mark the bottom, after we had been at 40 psig for the order of forty seconds, we saw a *gas jet* coming through the bottom *in the form of a flame.*" (Emphasis added).

When it was turned back to 10 psig:

[237] "... we saw a metal stream coming out.

Then the pressure was raised again to 40 psig, and we again saw *the flame* coming through, because 40 psig, of course, was enough to have *the jet* penetrate to the bottom.

Then the pressure was shut off and the rest of the metal, or most of it, ran through the hole." (Emphasis added).

> "The appearance of a *flaming gas jet* through the bottom of the converter proves that *the jet* penetrates to the bottom. Furthermore, the demonstration shows that *it is the jet* and not a downwardly descending stream of metal that cuts the hole through the bottom refractory brick." (Emphasis added). (DX-284 pp. 3, 4).

I take notice particularly that Dr. Flinn said he saw "a gas jet coming through the bottom in the form of a flame.", and it was "visible". This phase of the demonstration was not commented upon in the Opinion.

Dr. Elliott testified, inter alia, (PX-J-37 pp. 12363-12366) that the oxygen jet did not reach the bottom of the converter during this demonstration and that it, the oxygen, did not cause the hole in the bottom:

> "If oxygen had reached the bottom, here should have been oxygen in the stream leaving the vessel . . ."

And,

> ". . . conditions would be right for this oxygen to burn the iron in the stream, the spraying stream . . ."

He gave certain reasons on a scientific basis for why this was **[238]** true.

While Dr. Elliott claims that the hole was caused by the CO bubbles on the bottom which resulted from the downwardly moving stream saturated as it was with carbon and oxygen, I observe also that Dr. Chipman testified (PX-J-3 pp. 501-504) that it was silicon and oxygen which combined in the metal to form silica, SiO_2 which became destructive to the bottom refractory as it struck it. He said (PX-J-3 pp. 503-504):

> "Now, the formation of silica in contact with the refractory bottom—remember that we have a basic lining, the bottom is basic—the silica is acid. Silica is quite corrosive to basic refractories. This means, then, that if the hot spot is deeply immersed in the bath, the downward current can reach the bottom while it

is still at a high enough temperature to damage the bottom . . . In fact, it can put quite a hole in the refractory at the center of the bottom of the vessel."

OXYGEN DOES NOT BURN

FIRST. For our purposes here it really does not matter whether Dr. Elliott's carbon monoxide theory, or Dr. Chipman's silica theory is correct. What impressed me is that two of the defendant's witnesses were authority for the fact that oxygen by itself will not burn a hole in the brick work. One witness was Lyle Johnson, Vice President of Engineering of McLouth Steel. The evidence on that point was (PX-J-33 p. 11, 100):

"A .....
On the 20th we ran Test 13, which was a test where we blew oxygen into an empty vessel onto bare brick. This test simply proved that oxygen by itself will [239] not burn a hole in the brickwork.

THE COURT: Was the brickwork heated?

A. Yes, the brickwork was heated.

THE COURT: To what temperature?

A. I would estimate the temperature was approximately 2000 degrees, your Honor."

Also, McLouth General Superintendent, Hotmill Division, Mr. Paul Lindberg, contradicted Dr. Flinn's assertion that it is oxygen and not metal of extremely high temperature hitting the bottom which causes the refractory damage, when he testified as follows (PX-J-12 p. 3583):

"Q. That bottom marking is caused by the metal of extremely high temperature hitting the bottom, is it not?

A. Right underneath the oxygen lance, that is correct, sir.

Q. My statement is correct, that that marking is caused by the extremely hot metal?

A. That's correct, sir."

Thus, accepting the testimony of defendant McLouth's own witnesses, if the Demonstration No. 9 vessel had been devoid of metal, the oxygen when applied alone would not have burned a hole through the bottom.

We recall that Dr. Flinn said throughout this testimony that he saw the oxygen "in the form of a flame" and that "it was a flame". From this testimony we observe that at no time did Dr. [240] Flinn say that he saw a pure jet of oxygen extruding from the bottom of the refractory. He saw a "flame", and if he saw a "flame", it was a combustion—a combination of oxygen with some one or more of the oxidizable impurities contained in the bath in Demonstration No. 9, consisting of what we have learned in this case was iron, silicon, manganese, sulfur, phosphorus, carbon and other impurities.

From the specification itself we learned (col. 4 commencing with line 43) that because of the very high affinity of oxygen for molten iron, their combination creates an ignition which is visible in the form of a flame within the first minute of blowing, and that combination of oxygen with other chemicals in the bath soon develop the extremely high temperatures approaching the boiling point of iron.

Since Dr. Flinn testified that he saw a "flame" protruding from the bottom, it is inevitable that he did not see the oxygen jet protruding from the bottom. In fact, if it were pure oxygen, neither Dr. Flinn nor anyone else would have been able to see it; because it is common knowledge that oxygen is non-metallic, colorless, odorless, tasteless and inflammable.*

Dr. Flinn said it was "visible". It was a "flame". It was a "flaming jet". It was "coming through the bottom in the form of a flame."

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*Chemistry Made Simple, Fred C. Hess, page 111, published 1955.

[241] As for the flame from the bottom of the vessel in Demonstration No. 9, Dr. Flinn said (PX-J-22 p. 7291):

"A. We will see a high velocity flame coming through the bottom.

THE COURT. What will be the color of the flame.

A. It will be ——

THE COURT. Blue?[39]

A. No. It will be rather bright orange-red, your Honor." *

We note also that throughout the entire *McLouth* record there is no disagreement with the explanation of the oxidizable impurities existing in a molten metal bath, and that these combine with oxygen and produce high temperatures. Whether the refractory burning was produced by the high temperature of the oxidation-reaction of either carbon or silicon, or any other oxidizable elements in the bath, it definitely could not have been produced by the oxygen jet alone.

[242] In Demonstration No. 9 we are concerned with the destruction of the bottom refractory and the reasons for its destruction. In accordance with the teachings of the Suess process, it seems that the burn-through could have

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[39] The District Court could have thought of this in the same way as one commonly thinks (but does not always check) about the flame in a burner of a gas range. When the mixture of gas is too rich, it will burn yellowish to white, and when it has an adequate amount of oxygen it has a bluish flame. However, it will be remembered that it is the proper amount of oxygen which oxidizes almost completely the hydrogen and produces the bluish flame.

* "The flame produced by combustion consists of burning gases vaporized from combustible substance by heart of the reaction. The flame may be colored by energized ions emitting light energy as well as by bits of solid material heated to incandescence by the reaction energy." Chemistry Made Simple, Fred C. Hess, page 111, published 1955."

resulted when the hot spot or localized reaction zone moved from the surface and projected into the interior of the bath contrary to the instructions contained in the Suess specification. Consequently the bottom of the refractory lining was destroyed.

What we have examined here was only whether or not oxygen could have burned the bottom of the refractories, and I conclude that this should not have been used as a basis for discrediting Dr. Elliott's testimony.

35-40% versus 22%

SECOND. The first discredit ascribed in the District Court Opinion to Dr. Elliott on the basis of the "tangible evidence," Demonstration No. 9, is that he ". . . defined deep penetration by reference to such bottom damage (R. 6168-6169) . . . when the jet enters more than, say, 35 to 40 percent of the bath depth . . . [and] would have regarded the penetration in demonstration No. 9 as being at least 35 to 40 percent of the bath depth. Yet he later testified that the penetration of the jet in demonstration No. 9 was no more than 1.5 inches of a 6.8 inch **[243]** bath depth, or approximately 22 percent of the bath depth (R. 12,382, 12,610)." (257 F.Supp. at page 435).

The difficulty is that this statement as made here is erroneous because it compares two different sets of circumstances. As I first look at these two situations, I am alerted to the fact that the first is transcribed at PX-J-19 pp 6168-6169 while the second situation is transcribed at PX-J-37 pp 12,382, 12,610. As stated, it tells the reader "that Dr. Elliott would have regarded the penetration in demonstration No. 9 as being at least 35 to 40 percent of the bath depth." Nowhere in the record is there any evidence which could be imputed to Dr. Elliott that he stated or inferred or that he "would have regarded" such a percentage of depth in the demonstration No. 9 bath. On the other hand, his record testimony as related to Demonstration No. 9 was that (PX-J-37 pp 12,380-12,381):

> "The pressure was high . . . the oxygen flow . . . gave an enormous oxygen input . . . for a bath 6.8 inches deep and of a few hundred pounds."

And further, that (PX-J-37 p 12,382):

> "The indent *under these blowing conditions* would range between 6/10ths of an inch to approximately 1½ inches. 6/10ths of an inch to approximately 1.5 inches." (Emphasis added)

The District Court calculated this to be 22 percent depth of penetration by the oxygen jet. But regretably, the District **[244]** Court mismatched this 22 percent with the 35-40 percent depth of penetration in a totally different set of circumstances and arrived at a mis-interpretation upon which it misjudged the credibility of Dr. Elliott.

Under a completely different set of circumstances, Dr. Elliott testified that anything beyond 35-40 percent depth of penetration would be considered by him to be deep penetration contrary to the conditions prescribed by the Suess specification. This was related as an answer under cross examination (PX-J-20 p 6637):

> "*Under normal conditions indicated in the patent,* I would consider that deep penetration arises when the jet enters more than, say 35 to 40 percent of the bath depth." (Emphasis added).

Whereas, "the penetration in demonstration No. 9" was not "regarded . . . as being 35 to 40 percent of the bath depth." The misconception or mis-interpretation here of such a comparison was like comparing apples with pineapples—and what a difference it would make to anyone who wished to bite into an apple but inadvertently bit into a pineapple.

Dr. Elliott testified here (CE p. 257) that the Court misconstrued his testimony. He testified:

> "I would like to call [this] Court's attention to the statement at the top of the page 6637 **[245]** [McLouth]

> which says in my answer to a previous question, 'Under normal conditions indicated in the patent, I would consider that deep penetration arises when the jet enters more than say, 35 to 40 percent of the bath depth.' And that line, 'Under normal conditions . . .' is the important part of the statement . . . Now, the discussion [of the McLouth District Court] goes on to say, 'Yet he later testified that the penetration of the jet in demonstration No. 9 was . . . approximately 22 percent of the bath depth." (CE pp. 257-258)

Dr. Elliott then explained that he had testified that Demonstration No. 9 was unusual in that the oxygen input ". . . was enormous under these blowing conditions relative to the size of the bath . . . So, accordingly this is an abnormal operation, and the discussion in the opinion does not recognize the fact that I was talking about a normal condition under one circumstance and a very abnormal one under another; and, hence, I conclude that there is a technical misunderstanding." (CE pp. 258-259)

Thus, this fundamental misunderstanding of the *McLouth* District Court arose from that Court's attempt to equate deep penetration with an operation under highly contrived, experimental conditions.

In addition, it must be observed that the diameter of the nozzle used in the Ann Arbor demonstrations was .316 inches, for a weight of approximately 270 pounds. Calculating the proportion of what 270 pounds bears to a ton or 2,000 pounds, the result **[246]** will be .135. Multiplying .135 against the .04 inches prescribed by Suess gives us .0054, or the diameter in inches usable for 270 pounds. Comparing the diameter used in Ann Arbor of .316, for the 270 pounds, we divide .316 by .0054 and get the result of 58. *Thus we find that the .316 diameter for 270 pounds of melt is 58 times as much as that prescribed by Suess.* Accordingly, we see that in the continued demonstrations 58 times as much oxygen was introduced into the baths as was prescribed by the Suess specification. And while the

facility, and therefore the possibility existed for the introduction of 58 times as much oxygen in the demonstrations, that in itself might not have been proof that it in fact was introduced. I, accordingly, further examined the record to determine the amount of oxygen consumable under Example 1 of the Suess specification, and Demonstrations Nos. 7 and 9, and obtained these results.[40] Since excessive **[247]** disproportions exist between the oxygen consumed, we may fairly conclude two things: (1) that the large amount of oxygen, both capable of being introduced and, in fact, actually introduced into the bath, oxidized the bath impurities in a greater proportionally speedier time in both Demonstrations Nos. 7 and 9; and (2) that the demonstrations, being so excessively disproportionate to the Suess process instructions, would by reason thereof be legally incompetent evidence to discredit the Suess patent.[41]

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[40] The consumption of oxygen in Demonstration No. 7 proved by calculation to be approximately 27 times the amount recommended in Example 1 of the Suess patent, as that was calculated; while the consumption of oxygen in Demonstration No. 9 (as far as it went) was approximately 22 times the amount recommended in the Suess example 1, as both were calculated. To avoid any misunderstanding in this I repeat some of the calculation heretofore made and add the necessary part as follows:

> The theoretical consumption of oxygen for 270 pounds as calculated from Example 1 of the specification was 8.58 cubic feet. In Demonstration No. 7, 235 cubic feet (DX-281) of oxygen were consumed by a charge of 270 pounds. Thus, by dividing the theoretical value 8.58 into the actual amount of oxygen used, 235 cubic feet, it is found that the defendant used about 27 times the oxygen specified by the patent. Demonstration No. 9 can also be seen in similar terms. By taking the amount of oxygen consumed, 186 cubic feet (DX-285) and dividing the theoretical value of 8.58, it is seen that this experiment consumed about 22 times the recommended oxygen volume.

[41] Though I recognize that the *McLouth* plaintiffs stated in their brief (PX-K-1, p. 176) and in court (PX-J-3, p. 691, PX-J-8, p. 2475, PX-J-20, pp. 6417A-6420, 6423-6424, 6435-6436, 6442) that the

Accordingly, by reasons of such misunderstanding Dr. Elliott should not have been charged with a discredit in this connection; and, in justice, it could not have been used even as a fractional support for the District Court's observation that the Ann Arbor Demonstration No. 7 was to any degree "tangible evidence in the record tending to confirm that the concept of material agitation by the oxygen stream is a fiction." (257 F.Supp. at page 433) This determination corroborates the testimony of Dr. Elliott given here (See CE pp. 234, 295).

Comparison of End Results

THIRD. Because the burden rested on the defendant, it cannot be concluded that the steel produced in the Ann Arbor Demonstrations was of open-hearth quality. Dr. Flinn said the quality of steel produced in Demonstration No. 5 (PX-J-22 p 7377):

[248] "A. . . . shows the characteristic *ductility* of low carbon steel." (Emphasis added)

As for Demonstration No. 7, Dr. Flinn said (PX-J-22 p. 7379):

". . . we have bottom burning but we still make steel." But what kind of steel? Nothing was said about the quality of steels blown in the 185 seconds of demonstration No. 9.

There is no evidence in the McLouth Record that the Ann Arbor Demonstrations, particularly Nos. 5 and 7, both produced steel equal in quality to those with regular operations OP-1 and OP-2 at McLouth.

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teachings of 1 mm per ton of charge applied only to charges of approximately 35 tons, I also note that the purpose of Defendant's demonstrations was to prove that *patent* fallacious. Further, even assuming arguendo that the above calculations are not a precise indication of the relatively enormous amount of oxygen used in the tests, there is ample undisputed expert testimony that the quantity of oxygen supplied was excessive (infra page 243).

Dr. Flinn informed us (M DX-160—PX-12-B p. 1864b) that the silicon and "most of the manganese had been eliminated", but we are told nothing at all about the sulfur and phosphorus removal which is, according to all the steelmen for both the plaintiffs and the defendants, (as well as the defendant J & L), frustrated when the oxygen is injected deeply into the bath because it defeats the capacity of FeO to move into the slag and eliminate the phosphorus and sulfur (See. Dr. Elliott's testimony (PX-J-19 p. 6170) (257 F.Supp. at pages 388-389). Most important of all, there is not a single word in the *McLouth* record that any of the resultant products obtained from the Ann Arbor demonstrations produced "steels having analyses and qualities at least comparable to that of basic open-hearth **[249]** steels", as is the object of the Suess process (PX-1, col. 3 lines 4-5). That the Suess process has achieved this object has never been disputed by a single word in the entire *McLouth* record, in spite of the fact that McLouth, defensively asserted that Schwarz, Miles and Gerlafingen had already done so before.

If the Ann Arbor Demonstrations were intended to prove that the quality of steel in any of these demonstrations, Nos. 5, 7 or 9 were comparable to the products produced by the Suess refining process "which is applicable to pig iron of widely varying chemical compositions, including in particular pig iron of analyses used in ordinary basic open-hearth practice, as well as those of higher silicon and phosphorus content required for blowing in the acid Bessemer and basic Thomas converter processes to produce steels having analyses and qualities at least comparable to that of basic open-hearth steels" (PX-1, col. 2, lines 69-72 and col. 3, lines 1-5), there was no show of any such proof in the record. Demonstration No. 5 produced "ductile" steel and Demonstration No. 7 produced "good" steel. However, such is not good enough, for by narrowly specifying their quality or characteristics McLouth excluded them from the general class of "steels hav-

ing analyses and qualities at least comparable to that of basic open-hearth steels". *Inclusio unius est exclusio alterius.*

[250] The word "good" as used here is at most descriptive of only a questionable quality in the finished steel. The word "ductile" as it relates to metal contains a wide range of significance all the way from soft tin or gold to carbon steel or alloyed chromium steel. As the record here shows, "ductility" is but one of the many virtues required in industrial steel. Other properties are hardness, ability to be machined, brittleness, electric conductivity, magnetic permeability, magnetic hysteresis, permanent magnetism, and weldability.*

It is common knowledge that strength is steel's primary virtue. Of course, the true value in iron refinement into steel lies in the controlled and limited elimination of unwanted elements, such as silicon, sulfur, phosphorus, carbon and the like. When we look at the "good" steel or the "ductile" steel coming from the Demonstrations Nos. 5 and 7 at McLouth, we should look to the total comparison of these products with those resulting from the Suess process. Unfortunately, a complete comparison is not part of the record.

It should also be observed that the tests at Gerlafingen produced poor quality steel by reason of the practice of deeply deploying the oxygen into the bath as in the prior art of Miles and Schwarz with resulting high percentage of sulfur, and of the recital of the McLouth District Court of the difference in the **[251]** tests at Linz, Austria. (257 F.Supp. at page 410 et seq.)

Since the composition of finished steel as it is accomplished in the open-hearth process depends upon its free-

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* The Making, Shaping and Treating of Steel, Ninth Edition (1971), published by United States Steel, at pages 1231, 1275, 1136, 1206, 1162, 1137 and 1054.

dom from various undesirable impurities, or the inclusion of certain elements such as chromium for special purposes, the control of the process is vital. Aside therefore from a showing that Demonstration No. 5 produced .10 percentage carbon, it furnishes no evidence whatsoever of comparability with the open-hearth or the Suess process for that matter, nor with McLouth's own OP-1 and Op-2 operations. (See p. 253-254) Neither is there any indication in the record that the demonstrations could have been controlled so as to provide some similarity or comparability of controlled finished products as in the open-hearth as does the Suess process.

As for the quality of the product produced in Demonstration No. 7, we have no further information than that given in Demonstration No. 5, and no information that nozzles and refractories in Demonstration No. 5 and No. 7 were damaged. While these may not have been damaged, the absence of evidence of the quality of steel produced would give the processes very little more credibility beyond that of Gerlafingen or of the prior art [252] of Schwarz or Miles. Thus these processes under Demonstrations Nos. 5 and 7 would be considered unacceptable processes under Suess. The only blame we might give these two demonstrations, Nos. 5 and 7 for poor production quality would be in either an overabundance of oxygen because of the great width of the nozzle or in the greater depth of penetration by which the hot spot was moved from the top center surface as instructed by Suess to the center of the bath, thus creating the condition by which the Suess prescribed chemical process was disrupted.

It is also obvious that at least the character or quality of steel produced in Demonstrations Nos. 5 and 7 was not brought to the attention of the *McLouth* District Court, or for some reason went unobserved; because there is no mention or discussion of this in the Opinion. This factor also indicates a lack of comparability shown by Demonstrations Nos. 5 and 7 to the Suess process, as well as to

McLouth's OP-1 and OP-2. Such a showing was part of defendant's burden.

McLouth's Defendant-Appellee's Appendix Volume 11 (PX-K-12-B) shows that in the general mills at McLouth the finished production is variably controlled in order to produce either a minimum or maximum of wanted or unwanted impurities, particularly carbon, where the same is desired. Our concern is whether or not Demonstrations Nos. 5 and 7 produced steel **[253]** comparable to the open hearth capabilities, but in the very least to the capabilities of McLouth's OP-1 and OP-2 which claims to produce steel "of a quality comparable to that produced by the open hearth process." Thus we are able to see from the record of McLouth that the raw production and the finished production of OP-1 are as follows (PX-K-12-B p. 1755b):

RAW PRODUCTION

Element	*Percentage Range*
Carbon	4.2 to 4.6 %
Manganese	.70 to 1.30
Silicon	.75 to 1.30
Phosphorus	.14 to .19
Sulfur	.019 to .050

FINISHED PRODUCTION (PX-K-12-B p. 1765b)

Element	*Percentage Range*
Carbon	.04 to .30%
Manganese	.20 to 1.20
Phosphorus	.030 max.
Silicon	.30 max.
Sulfur	.030 max.

The raw production and finished production at OP-2 are as follows:

RAW PRODUCTION (PX-K-12-B p. 1828b)

Element	*Percentage Range*
Carbon	3.75 — 4.25%
Manganese	0.40 — 1.70
Silicon	0.50 — 1.70
Phosphorus	0.11 — 0.19
Sulfur	0.010 — 0.050

[254]

FINISHED PRODUCTION (PX-K-12B p 1838b)

Element	*Percentage Range*
Carbon	0.04 — 0.60 %
Manganese	0.16 — 0.40
Phosphorus	0.030 max.
Sulfur	0.030 max.
Silicon	0.30 max.

From this record it is obvious that the furnaces in both OP-1 and OP-2 at McLouth are variably controlled to produce finished steel of specific character and content. In fact, McLouth states for both OP-1 and OP-2 (PX-K-12-B pp. 1739b and 1811b) the following:

> "The oxygen steel process practiced by the McLouth Steel Corporation at its Trenton, Michigan plant is normally used to refine molten pig iron from McLouth's blast furnace[s] into low or medium carbon steel of a *quality comparable to that produced by the open hearth process.*" (Emphasis added)

This is an assertion that it does produce steels of such quality as is claimed by the Suess process.

The purpose of examining these "before" and "after" contents in these OP-1 and OP-2 operations is to indicate the absence of similar statistics in the input and output of Demonstrations Nos. 5 and 7, notwithstanding the assertions of its experts of the production of so-called "ductile steel" or "good steel" by these demonstrations. Nowhere in the record did McLouth make claim that the

quality of "good" or "ductile" steel produced in Demonstrations Nos. 5 and 7 were "comparable to that produced by the [255] open hearth process," or even to their own processes at OP-1 and OP-2.

I notice one other failure to produce evidence that I would have considered persuasive or lacking in persuasiveness in the *McLouth* trial. Although there are records of the number of blows which the refractories at OP-1 and OP-2 can accommodate, there is no evidence of length of wear in the operations conducted as Demonstrations Nos. 5 and 7. As for No. 7. The indication is that it was damaged by reason of the 40 psig jet pressure.

There is no doubt that the Ann Arbor Demonstrations were not models of the Suess process, or examples of the process as it was described and instructed in the Suess specification, or as practiced at McLouth. Consequently, the critical failure on the part of the defendant to meet its burden, negates any inference drawn from the Ann Arbor demonstrations.

Evidentiary Substance of Ann Arbor Demonstrations

FOURTH: The purpose of presenting the Ann Arbor demonstrations by McLouth was to show that in Demonstration No. 5, penetration at least to the center of the 6.6 inch metal bath was appropriate; that deep penetration by the oxygen jet at double pressure in Demonstration No. 7 would make a depression in the bottom of the vessel, while at the same time "ductile steel" was produced; and [256] in Demonstration No. 9 that the refractory bottom was destroyed by the oxygen jet and not by the molten metal.[42] However, nothing was said by the defendant Mc-

[42] These demonstrations were apparently an effort by McLouth to corroborate their contention that in their OP-1 and OP-2 oxygen blowing operations, they peneterated the jet deeply into the bath in accordance with the Schwarz and Miles patents. The District

Louth about "material agitation of the bath by the oxygen jet."

And yet, relying upon Demonstration No. 7 as a support, the Court found that the "material agitation" mentioned in Claim 1 was non-existent and a fiction.

This conclusion was based upon Demonstration No. 7 where "the agitation of the bath as shown by the throw-out subsided near the end of the blow, although the action of the oxygen jet remained constant . . . It is obvious, therefore, that the action of the oxygen stream alone was not responsible for the agitation of the bath causing throw-out"; that "Demonstration No. 7 illustrates that even with deep penetration of the bath by the jet, such agitation . . . results from *chemical reactions,*" and not mechanical action of the jet; and, that "if deep penetration as well as non-deep penetration fails to bring about **[257]** an agitation of the bath by the oxygen stream, as in Demonstration No. 7, then there can be no logical correlation between the avoidance of deep penetration and the avoidance of material agitation of the bath by the oxygen stream". (Emphasis added) (257 F.Supp. at page 434).

Thereafter the Court linked Dr. Elliott to certain references which he had made to the specification and concluded that this was done in an effort to equate avoidance of deep penetration with material agitation, but that no such correlation was taught in the specification; that Dr. Elliott had "himself relied on the quieting of the bath at the end of the blow as in demonstration No. 7 as a sign of avoidance of material agitation of the bath by the oxygen stream"; and that Dr. Elliott's testimony did not present "a clear or consistent meaning" because he testified that the refractory walls were damaged as a result of an upward moving stream of hot metal and the bottom refractory was

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Court disagreed, and held that they practiced the Suess Process. (257 F.Supp. at page 386).

damaged as a result of downward moving hot metal in the center of the bath. "Clearly circulation cannot be both up and down in the center at the same time." (257 F.Supp. at page 435)[43]

[258] Then, of course, the second reason for Dr. Elliott's "inconsistent definitions of deep penetration, as illustrated by defendant's demonstration No. 9" was that Dr. Elliott had given two contradictory definitions of deep penetration.[44]

In examining the reasoning of the Opinion as it relates to demonstration No. 7, it will be seen that the word "if" is used three times in its structuring. First (at page 434) in the fifth and sixth lines, the Opinion said "If the bath agitation . . ." Second, in the twenty-fourth line, it says "But material agitation by the oxygen stream . . ." Third, in the thirty-seventh line, it said "But if deep penetration as well as non-deep penetration fails . . ."

First of all let us examine the fact that the Opinion relates the quieting of the bath at the end of the blow as occurring because of cessation of chemical reaction. If the District Court had taken this thinking from the phraseology contained in the specification on that very point, it could not be more accurate. This is what the specification says (col. 6, lines 66-72):

[259] "When the flame dies and carbon combustion is completed, the bath becomes relatively quiet and intimate contact between slag and metal bath ceases. The turbulence of the bath and slag due to the oxygen stream impinging from directly above is insufficient to cause continuance of oxygen-metal reactions."

So that when the Opinion states, "If the bath agitation causing such throw-out of metal and slag had been caused

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[43] I discuss this phase at Compendium *XIV*.

[44] I discuss this under this Chapter, pages 243-244.

by the mechanical action of the oxygen stream alone, the throw-out would not have ceased as it did near the end of the blow" (257 F. Supp. at page 434), it presumed upon that which the specification did not say. And when the Opinion further states that, "It is obvious, therefore, that the action of the oxygen stream alone was not responsible for the agitation of the bath causing throwout of metal and slag during the major part of the blow", (257 F.Supp. at page 434), it stated that which the specification almost verbatim states. Then when it concludes that "Demonstration No. 7 illustrates that even with deep penetration of the bath by the jet, such agitation of the bath as may occur results from chemical reactions rather than the mechanical action of the oxygen jet upon the bath" (257 F. Supp. at page 434), it verifies not only the Suess process chemistry but the prior art as well. But when it reasoned that, "Applying *plaintiffs' own argument*, 'material agitation of the bath by the oxygen stream' was also **[260]** avoided in demonstration No. 7 despite deep penetration of the bath by the oxygen jet" (Emphasis added) 257 F. Supp. at page 434), it relied upon an unfounded presumption. So that when it furthered the next two presumptions contained in the rest of the paragraph, as they commenced with "but if", they are regrettably not based upon facts, because material agitation by the oxygen stream is not "avoided, even with deep penetration" and "such agitation" is not apparently always avoided when blowing vertically regardless of the depth of penetration and "deep penetration as well as non-deep penetration" does not fail to bring about an agitation of the bath by the oxygen stream as in Demonstration No. 7 (257 F.Supp. at page 434). To the contrary, the plaintiffs' argument was always that deep penetration by the oxygen jet did cause material agitation in the bath. It was, regrettably, unknown to the *McLouth* Courts that this was the specific idea concerning the deliberations in the Patent Office on May 1, 1957 before the patent issued. The words of the Primary Examiner,

Claude A. LeRoy, in evidence presented to me at the first post-trial hearing, bear repetition here. (PX-1002 pp. 9-10):

> "... we had considerable discussion as to the positive manner in which they would define that feature of having the penetration extended down into the bath, just a rather insubstantial **[261]** distance as far as the prior art was concerned. It was well understood in the art that deep penetration meant a considerable distance into the bath and they wanted to avoid that concept, so I tried to bring their—bring to their cognizance that it was a localized penetration, and *so the language that we finally adopted* was to bring out that feature. (Emphasis added)

Under the circumstances, it would be highly unlikely that the "plaintiffs' own argument" would be that 'material agitation of the bath by the oxygen stream' was also avoided in demonstration No. 7 despite deep penetration of the bath by the oxygen jet." (257 F.Supp. at page 434).

Assumption

Nevertheless, the opinion continued to carry through the assumption and related it to Schwarz and Miles in this language:

> "And *if* the language of the patent in suit referring to the avoidance of material agitation covers the actual practice of steelmaking under the Schwarz and Miles patents, then plaintiffs can hardly rely on such language of the claims as a characteristic of the process essential to novelty. In other words, if Schwarz and Miles avoided material agitation of the bath by the oxygen stream even with deep blowing, then such avoidance of material agitation by the oxygen stream cannot be considered a significant feature of the claims of the patent in suit." (257 F.Supp. at pages 435-436) (Emphasis added).

Here we see a structuring of assumptions again in the Opinion inter-connecting a series of phases. First of all

"the [262] language of the patent in suit" not necessarily the exact words in the claim "referring to material agitation" does *not* cover "the actual practice of steelmaking under the Schwarz and Miles patents". In fact the opposite is true, both Schwarz and Miles practiced using the oxygen jet or jets, as the case may be, to *stir* the bath by deep blowing, angular blowing, non-vertical blowing, non-central blowing, or multiple jet blowing or by blowing pulverulent or fuel materials, and thus procured maximum material agitation of the bath.[45] Therefore, Schwarz and Miles did not avoid material agitation, but rather taught it as a necessary part of their processes to be accomplished with deep blowing. The opposite is true of Suess. Therefore, the opposite conclusion which eventually and actually achieves the "avoidance of material agitation by the oxygen stream" can be considered significant features of the claims of the patent in suit.

[263] From this we see that there are at least two phases interconnecting: (1) the vertically, centrally and surface placed localized reaction zone by Suess, and (2) differentiation from the prior art, especially Miles. And we now see that the two cannot be separated; for if there is no localized reaction zone as instructed in Suess, there consequently results unwanted stirring of the bath by the jet. If the instructions contained in the specification are not followed, we may have a too light impingement of the jet which would cause slopping; and, further, if the instructions are disregarded and the jet is discharged even within the specified limits but off center, or diagonally or provided with too much pressure or placed too deeply or too close to the surface, the localized reaction zone or hot spot is dislocated

[45] This does not include the necessary Suess instruction providing for ratio of bath depth to bath diameter or nozzle diameter (PX-1 col. 4, lines 7-25; PX-1, col. 3, lines 58-60). By the term "deep blowing" I have excluded the general Suess instructions as to height of nozzle, pressure of nozzle and the like.

from the top center surface of the bath where it is fixedly featured by the Suess specification.

Under any or all of these circumstances there is no localized reaction zone at the center surface of the bath: in the case of a too low pressure, an insufficient impingement with the metal and too much impingement with the slag; and in the case of the off-center, diagonal, or too heavy pressure, no localized hot spot in the central surface of the bath, but instead an elongated oxidizing instrumentality which diffuses the high **[264]** temperature area in the direction in which the jet is pointed. In all these instances, the oxygen jet is mechanically applied and so the oxygen jet materially creates the agitation indicative of prior art in these instances and against which the terminology in Claim 1 cautions. All of this offers further substantiation that the plaintiffs could not contend that "material agitation of the bath was also avoided in demonstration No. 7 despite deep penetration of the bath by the oxygen jet."

The last quoted "but if" assumption seems to be based upon a slender conclusion of one of the phases which the plaintiffs' expert witnesses submitted on the 3000-8000 units of chemical force or power versus the 1 unit of physical jet force or power. Whereupon the District Court found that:

> "Plaintiffs take the position that material agitation by the jet is avoided unless a down in center circulation induced by chemical reactions is overcome by the force of the jet (E.g. Main brief, pp 191-194; R. 13,331-13,332)." (257 F.Supp. at page 435),

and arrived at the assumption that

> "But if such material agitation is avoided whenever a reaction induced circulation is not overcome by the mechanical action of the jet, then . . . the language referring to the avoidance of material agitation by the jet is merely extraneous." (257 F.Supp. at page 435).

It then goes on to say that

> ". . . the real reason for the inclusion of language in the claims of the patent in suit concerning the [265] avoidance of material agitation by the jet was the desire by the applicants to distinguish the prior art Miles patent, . . ." (257 F.Supp. at page 435).

This purpose, as I have already discussed it, does not discredit the patentees, but rather supports their purpose in fact and law. *Eagle Iron Works* v. *McLanahan Corp.*, 429 F.2d 1375, C.A. 3, 1970; *Epstein* v. *Dennison Mfg. Co.*, 314 F.Supp. 116 (D.C.N.Y., 1969).

Thereupon, the Opinion concluded:

> "In effect, the specification of the patent in suit presented a new theory of agitation caused by chemical reactions, and the claims referred to an avoidance of agitation by the jet to give the impression of an entirely new steelmaking process." (257 F.Supp. at page 435).

Here again we see a misapplication in the use of words, because "the specification of the patent in suit" did *not* present "a new theory of *agitation* caused by chemical reactions", but rather the specification presented a new theory of circulation caused by chemical reaction. Additionally, the claims referred to the method of producing that chemical circulation and the reference to "an avoidance of agitation by the jet" only reflected the detailed instructions given in the specification "of an entirely new steelmaking process". Therefore, it seems that the Opinion misapprehended and interchanged the thought [266] contained in the specification with a part of the wording of the claim by the use of the word "agitation" and related it to "chemical reactions". The only thing that the specification and the claim indicate is that there is a physical function for the operator, and a resultant chemical reaction thereafter. The claim after a proper reference to the subject matter, offers further guidance to the operator to so

discharge the stream of oxygen within limits of pressure vertically, downwardly through the slag layer onto and below the surface of the bath at the central portion thereof "to an extent to avoid material agitation of the bath by the oxygen stream" (col. 12 commencing with line 12), so that such contact of the oxygen with the bath results in the reaction which produces chemical results in accordance with the instructions of the specification.

After having built upon its adopted assumption, the Opinion continues:

> "However, if material agitation by the oxygen stream is a fiction, as defendant's demonstration No. 7 and other evidence strongly suggest, then even under the process as taught by Schwarz and Miles, chemical reactions rather than the mechanical action of the jet must have been the actual cause of agitation in the bath. At least plaintiffs have failed to prove otherwise." (257 F.Supp. at page 435).

This ignores the constant efforts of the plaintiffs to establish their theoretical belief and contention that the oxygen-reaction **[267]** process is the chemistry which produces the pattern circulation in the bath by virtue of the Suess patent specification instructions. And from the Opinion's words "at least plaintiffs have failed to prove otherwise", by virtue of the voluminous proof in the case it can only be that the fact finder never realized it was there. Furthermore, the burden "to prove otherwise" was upon the defendant and not upon the plaintiffs. *Radio Corp. of America* v. *Radio Engineering Laboratories,* 293 U.S. 1, 7 (1934); *United Mattress Machine Co., Inc.* v. *Handy Button Machine Co.,* 207 F.2d 1, C.A. 3, 1953.

I have previously discussed the loose interchangeability of the word "agitation" particularly as it was used in the Opinion in connection with Demonstration No. 7, and as it was related to "throw-out" with the word "turbulence" as it designated bath action from whatever sources. I have

observed the word "agitation" was also loosely interchangeable with significance of the word "agitation" in its physical sense as it was used in Claim 1. As demonstration No. 7 is now here being used to discredit Dr. Elliott's testimony, the word "agitation" is used to embrace totality of action both in and out of the bath—as it was visible during the conduct of the blow. Thus it included both 20 psig blowing and 40 psig blowing with the nozzle presumably **[268]** directed both vertically and centrally onto the bath. When in the sense of Schwarz, the nozzle is being used as "a kinetic energy that . . . is capable of penetrating deep in the manner of a solid body, into the liquid baths." (DX-5-A, page 5, lines 24-25, page 6, line 1); and in the sense of Miles "The jet serves to circulate and agitate the metal and the slag . . ." (DX 10-A, page 18, lines 8-9). Thus demonstrations Nos. 7 and 9 were prior art operations.

Prior to the grant of the instant Suess patent, one of the applicants, Dr. Hauttmann, filed an affidavit with the continuation-in-part application in which it was stated, inter alia, ". . . our concept of securing purification of the entire contents of the bath mainly by the *controlled circulation induced by the reaction center* is just the opposite of trying to carry the oxygen to all parts of the bath by *agitation produced by deep penetration* * * *" (Emphasis added) (DX 2-A page 92). Thus the term "agitation" produced by deep penetration had significance to the applicants and to the Patent Office as well, but it is doubtful that it would have any significance to one not expert in the art of steelmaking.

The distinction between the "physical" turbulence and the "chemical" turbulence was explained in the first post-trial hearing before me by Byron T. Gardner who prosecuted the **[269]** continuation-in-part application before the Patent Office as follows: (FWE, at pages 17-18):

> ". . . In the Miles process, the oxygen jet was blown at high velocity against the surface of the molten bath

> so it would penetrate almost to the bottom of the charge with the result that the oxygen was distributed completely throughout the molten charge, producing great *physical turbulence* as compared with the *chemical turbulence* and supposedly producing a very complete reaction and purification of the bath. As a practical matter, it didn't work that way. The *mixing* or *agitation* of the bath by the oxygen stream developed very high temperatures throughout the entire bath with the result that the walls of the converter or vessel formed of refractory material was badly eroded and only a relatively small number of charges of molten metal could be refined before relining was necessary." (Emphasis added)

Accordingly, we see that demonstration No. 7, with the exception of the placement of the nozzle vertically and centrally, was conducted in accordance with the teachings of the prior art. However, what was observable to the expert, Dr. Elliott, as the distinction between "chemical turbulence" and "physical turbulence" due to deep penetration in Demonstration No. 7, was not apparent to the non-expert senses of the District Court, in spite of the fact that uncontradicted expert testimony of that condition was presented in evidence to the District Court.

Although the testimony was directed in relation to Demonstration No. 9, and the 40 pounds driving pressure exerted there, it was also related by the witness to Demonstration No. 7 **[270]** in which the 40 pounds driving pressure was used and the heat was completed "in a very few minutes".

Demonstrations Nos. 7 and 9 were presented by McLouth to illustrate the effects of 40 psig blowing. A portion of Dr. Elliott's testimony was as follows (PX-J-37 pp. 12,380-12,381):

> ". . . we are talking now of 40 pounds driving pressure with a 6.8 inch bath depth, and a good vigorous reaction going on in the system.

THE COURT: Is there anything unusual about the combination of those conditions?

A. It is an enormous rate at which the—the oxygen input was enormous under these blowing conditions relative to the size of the bath, the quantity of metal in the bath. As I remember it, the blowing conditions led to a completion of the heat in one of the other demonstrations in a very few minutes . . . And the resulting oxygen flow was very large . . . The pressure was high, but my basic point is that the oxygen flow resulting from that pressure on this nozzle gave an enormous oxygen input. My answer focuses on the rate of supply of oxygen as a result of the blowing conditions. This rate of supply was very large for a bath 6.8 inches deep and of a few hundred pounds."

While this testimony of Dr. Elliott remains uncontradicted in the record, no reference was made to it in the Opinion where it went disregarded.

[271] **XIV. Up and Down at The Same Time**

The second discredit ascribed to Dr. Elliott was to his testimony wherein he said that "deep penetration causes an up in the center circulation, which may cause refractory wear on the walls near the bath surface (R. 6146-6156; PX-349)," and when "he later testified that deep penetration causes bottom damage to the refractory (R. 6166) as the result of a downward moving stream of hot metal in the center of the bath (R. 12,340-12,343, 12,363)." With this discredit ascribed to Dr. Elliott, the finding was made that, "Clearly, circulation cannot be both up and down in the center at the same time." (257 F.Supp. at page 435)

Here again we see another case of mistaken circumstances where there is a mismatching of apples and pineapples. The first clue which we have of this misunderstanding is that the testimony relating to "deep penetration" causing "an up in the center circulation . . ." and "refractory wear on the walls near the bath surface" is contained

at (PX-J-19 pp. 6146-6156) (PX-349) whereas the testimony of "deep penetration [causing] bottom damage to the refractory as the result of a downward moving stream of hot metal in the center of the bath" is **[272]** recorded at (PX-J-36 pp. 12,340-12,343 and PX-J-37 p. 12,363). In examining these two different portions of the McLouth transcript, we find that in the first instance Dr. Elliott was explaining the chemically induced circulation which resulted by following the instructions contained in the Suess patent specfication and the advantages of such a circulation as promised by the Suess patent from chemical reactions. This was explained as opposed to the mechanical circulation produced by deep penetration of the oxygen jet into the bath as in the case of the prior art, and its effect, not only upon the chemical process as prescribed by Suess, but also as damage to the refractories.

In this part of the testimony Dr. Elliott explained that chemical functioning of the Suess patent eliminated the need for the stirring action produced by the deep penetration of the prior art; that there was a substitution of such stirring action by a chemically produced circulation initiated at the top central surface of the bath, as instructed by the Suess patent specification. He further explained how the prior art of deep penetration produced an unwanted mechanical action in the bath and refractory damage.

[273] In Suess' instructions the circulation was chemically downward and proceeded as the patentees had believed it would and, at the same time, protected both the bottom refractory and the sidewall refractory. Whereas, in the prior art, mechanical circulation forced the circulation upward in the center and outward to the sides. In the latter practice the hot upward and outward flowing metal was forced to make more direct contact with the refractory during its downward flow and as it flowed inwardly at the bottom of the vessel.

Dr. Elliott explained that in the Suess prescriptions the hot metal had a circulatory movement along the bottom and sides as well as at the top which provided it with a cooling effect. Whereas in the case of the mechanical action of the jet with its flow upward in the center, there was no accommodation for cooling, and as the metal came in contact with the bottom and side refractories, they eroded or were damaged. At this point Dr. Elliott's testimony had nothing at all to do with the Ann Arbor Demonstration No. 9, but only with the Suess patent specification instructions and disobedience to such instructions in what would be an ordinarily comprised molten metal bath as prescribed for industrial use.

[274] This, however, is only a part of my inquiry and study which shows that paradoxically ". . . . circulation [can] be both up and down in the center at the same time" in a molten metal bath which is activated by an oxygen blow; but more especially where it is carried by a centrally and vertically placed oxygen jet directed to the surface of the molten metal bath.

On the basis of one of its defenses that circulation in the center was always upward in the bath, McLouth produced several expert witnesses. Particularly, it presented the testimony of Dr. Robert D. Pehlke, an Associate Professor of Metallurgical Engineering of the University of Michigan, (PX-J-38, pp. 13,051-13,059), who testified that he observed such a circulation. In any event we have no argument from McLouth that there is an up in the center movement in the molten metal bath as the jet impinges. The plaintiffs say that when the jet is placed low in the bath, as practiced by the prior art of Schwarz and Miles, the result is a mechanical motion or movement upward in the center. Thus, there is then no disagreement from either the plaintiffs or defendant on this point. The main contention lies with what happens when the oxygen jet is placed at the top center of the bath in accordance with the prescription of Suess.

[275] I mention here first of all that the Suess patent specification asserts that the oxygen reacts first with the iron, then the silicon and manganese, and within the first minute develops extremely high temperatures in the zone of direct oxygen contact (col. 4 beginning with line 43); and that there was a more than one-way movement of the newly formed iron oxide with "A portion of the iron oxide goes to the slag . . . and a portion diffuses into the bath" (col. 4, lines 54-56). Thus we know that iron oxide is first of all forced upward and outward into the slag, as well as downward into the bath. Here we already see the first phenomenon of both up and down movement in the bath. Dr. Chipman described this phenomenon in detail (PX-J-2, p. 384) and said:

> "Sometimes I think there is quite a large amount of metal included in these bits and pieces and blobs which are thrown out of the furnace. The throw-out here is due to chemical reactions existing in this highly heated zone."

He then followed with this (PX-J-2 p. 385):

> "Now, other things show up as a consequence of the chemical reactions. One of these, and a very important one, is a downward central blow of metal immediately under the highly heated surface area."

Dr. Shapiro corroborated this when he said (PX-J-12 p. 3180) **[276]** that an explosive occurrence in a liquid bath would cause exerted forces in all directions, but mainly vertically. It was here that Dr. Shapiro attempted to corroborate his statements by various demonstrations, one of which the Opinion spoke of as an "explosive bubble" mechanism but which the District Court discredited because it "was admittedly not contained in any literature prior to the time of trial." (257 F.Supp. at page 438). Dr. Shapiro submitted to the *McLouth* District Court a series of demonstrations which involved a significant number of explosive squibs and oxy-acetylene ignitions in water

baths, but none of these are mentioned in the District Court Opinion.

Here, I refer to the undisputed testimony of Dr. Shapiro when he said (PX-J-13 pp. 4077-4079) that an explosive occurrence in a liquid bath would cause exerted forces in all directions, but mainly upward and downward.

"A. The jet does or can spatter up some liquid. I am referring now to liquid which is thrown up by the explosive mechanism.

Q. Well, can you identify any liquid which is thrown up by the explosive mechanism in an oxygen converter?

A. Yes, sir, I can distinguish between the two . . .

[277] Q. (By Mr. Groner) How can you identify it from that which might be thrown up by the mechanical force of the jet?

A. I can mention three which come to my mind, three situations which show that the upthrown liquid is due to explosions and not to the mechanical action of the jet.

In the McLouth operation as well as in the Fontana operations, as well as in other L-D operations that I have been told about— . . . The violent throw-up activity which persists through most of the heat dies down and is not present at the end of the heat.

Now, it is my understanding that in the McLouth operation, the lance distance is lower near the end of the heat. If the throw-up were due to the jet spatter, then I would expect at the end of the heat more throw-up. But the violent throw-up disappears . . .

The second point I would make refers to the Linz rudder tests and the associated films which Mr. Wallner showed. There was a great deal of throw-up in those tests.

I would mention first the throw-up was of the irregular character involving large hunks and globs of metal which, from experiment, I have seen arises from explosions and not from jet spatter. . . .

The Linz rudder experiments, if one puts together the observations on the throw-up and the observations on the rudders themselves as to the fact that there is downward circulation in the center, leads to the conclusions that there must have been explosions present. If there were no explosions present, there would be no way of accounting for the direction of [278] the observed circulation. If the throw-up seen there were primarily due to the mechanical action of the jet, the circulation would have been opposite to the circulation shown by the rudders.

I might mention furthermore in support of my statement regarding the source of the throw-up the experiments described by Dr. Chipman, in which he blew on pig iron, on carbon-bearing iron, and on iron free of carbon with different gases. He showed that when there were no chemical reactions occurring in the melt between oxygen and carbon, if there was any spatter at all, it was an extremely small amount compared with the violent throw-up that occurs when there is a reaction between oxygen and carbon in the melt."

While Dr. Shapiro was showing a movie of multiple-squib explosions (PX-J-12 p. 3615) he stated:

"The air above the vessel is, one might say, literally filled during the entire interval with liquid which has been thrown up. . . .

Each explosive bubble drives vertically downwards carrying liquid with it. At the same time, each explosive bubble sends vertically upward large amount of liquid water which proceeds above the free surface. The gas bubbles moving downward drag liquid with them. The down-moving column of liquid, when it reaches the bottom, moves outward radially along the bottom of the vessel . . ."

Referring to films of demonstrations at Wayne University, Dr. Shapiro was asked his observations, and he replied (PX-J-12 p. 3635):

[279] "We have just witnessed the experiment from a gallery seat more or less above the vessel. My observa-

tion was that the up-thrown liquid came substantially from the central region of the bath."

When asked about his conclusions, he stated (PX-J-12 p. 3637):

". . . The third conclusion is that concurrently with these events below the surface which arise from the explosions, there is a large amount of liquid thrown-up above the surface. That liquid throw-up above the surface is characterized by its generally vertical direction and by the fact that it is unsteady and irregular, appearing in the form of larger and smaller pieces and slugs of fluid of various shapes."

And further he said (PX-J-12 pp. 3648-3649):

". . . One sees here the electrodes in the bath, with bubbles rising and occasional explosions of those bubbles. The exploring bubbles drive downward, and one can see in the bath a toroidal circulation, which is downward in the center and upward at the walls. One can also see that each time there is an explosion, there is an extremely large amount of throw-up above the explosion area in a generall vertical direction."

Dr. Shapiro described the thrown-up material he had seen in McLouth's actual operations and the water demonstration he had performed with explosive squibs and exploding oxy-acetylene gas showed that explosions will cause the type of throw-up he observed at McLouth's plant, and stated at (PX-J-12 p. 3701):

". . . The direction of the material being thrown up showed that the material came from the central region of the bath. This means that the material [280] had to move upward against the action of the jet. It had to pass countercurrent through the jet itself and manage to find its way out through this very small opening.

In my opinion, nothing could account for this except for explosions in the central part of the vessel which ejected material vertically upward at very high speed."

Another series of tests was presented before me and I have recorded the demonstrative activity which resulted, as well as their evidentiary values. These are referred to in the portion of the *J & L* Opinion concerning Infringement. From my observation of these demonstrations presented before me by Dr. Kemper, I have not the slightest doubt that such an ignition in visible water baths definitely confirms both an upward and downward movement in the bath at the same time.

This action-reaction is familiar, when water suddenly and forcefully leaves a nozzle of a hose, and a backward reaction is felt by the one holding the hose. The oxidation process as oxygen makes contact with the molten metal at the surface is explosive. Thus, the theory when explained by Dr. Chipman takes on meaning. It is more particularly significant as follows (PX-J-4 pp. 980-981):

"Q. Now again getting to this assertedly explosive movement which drives the metal and the CO bubbles downwardly, why or what **[281]** is the basis of your theory that the explosions drive downwardly rather than some other direction, Doctor?

A. The metal which is thrown out is generally upwardly. At some plane, certainly above the horizontal, and much of it goes quite high. For each action there is an equal and opposite reaction, so that opposing and upward component of throw-out there is an equal and opposite action downwardly which must be expected and looked for.

Q. There also is an action in every other possible direction, isn't there, Doctor?

A. Each always balanced by an equal and opposite action.

Q. Then if you have equal and opposite actions in all directions, how do you have a downward flow, Doctor?

A. To compensate for the upward throw-out."

It is not difficult to understand that the explosive force in the liquid bath is no different from the explosive recoil which is occasioned by firing a bullet in a gun. This principle of action and reaction is explained by Newton's Third Law of Motion that for every action there is an equal and opposite reaction. Therefore, action and reaction in the bath triggered by the explosion would be equal and opposite.

Thus as relates to Dr. Elliott's earlier testimony explaining the chemical action and reaction in the bath, as it [282] would be exeplified by surface contact and explosions and by the mechanical deeper oxidation forces with their reactions, there is considerable scientific authority to corroborate him. And as his testimony relates to Demonstration No. 9, and we examine the conditions under which Demonstration No. 9 was made, we quickly become aware of the fact that in the shallow bath of 6.8 inches, the capability of introducing 58 times as much oxygen into the bath to 22% of its depth might indeed be close enough to the bottom to bring the high temperatures, which the oxidation-reaction created, in direct contact with the refractory and damage it. Nevertheless, Dr. Elliott's testimony, it would seem, does not present a basis for disbelief primarily because (1) the District Court Opinion does not set forth any contradictory evidence by any of the experts, but especially those of the defendant, and (2) because the record otherwise fails to disclose that where deep penetration occurs, that the sidewalls at the interface are not damaged. Dr. Elliott clearly set forth this fundamental misunderstanding in his testimony here. See CE pp. 234-295. It is plain from this, that a patent does not depend upon the necessity of the applicants knowing the scientific "how and why" of the working of their patent. An applicant is only required to produce a [283] working patent. My discussion of the scientific principles and theories involved, as they were developed and presented only for the purpose of ascertaining whether or not there was any misconception of the scientific values,

or any misinterpretation of expert testimony, which may have unjustly formed the basis of the final determination, and if so to report it. We have observed here that although there was a heavy burden upon those who sought to discredit the patent or to show that any one of its ingredients as claimed by the patentees was either unnecesary or an injurious part of the whole patent, *Martin* v. *Sears*, 317 F. Supp. 1089 (D.C.Tex. 1970); *Phillips* v. *Thermal*, 311 F. Supp. 17 (D.C.N.J. 1970), failure or success of the defendant in the case to meet that burden would become a critical part of these cases before me. The defendant has failed to do so, and I conclude that the combustion process of oxygen with the oxidizable materials in the molten iron bath when so injected can produce (1) movement of the molten iron bath upward and outward against the interface between the slag and the surface of the bath and potentially damage the sidewalls; (2) can move downwardly at the same time and potentially damage the bottom refractory; and (3) that circulation *can* "be both up and down in the center at the same time."

But whatever the direction of circulation is in actual practice, I must re-emphasize that the patentees are not [284] required to understand every scientific principle or reason for the success of their method; *Eames* v. *Andrews*, 122 U.S. 40, 56 (1886). Indeed, as previously stated, it would be remarkable if anyone could so understand the complexities of the patent in suit.

[285] **XV. Prior Art Changes—From Linz Tests**

In pointing out what they considered the various inconsistencies of the District Court Opinion, the plaintiffs referred to the comment made by the Court (257 F.Supp. at page 440) that:

> "It would seem, therefore, that the distinction between the claims of the patent in suit and the prior art practice may well be a purely verbal one. In this connection,

it must be noted that plaintiffs had considerable opportunity, both before and during the trial of this suit, to conduct steelmaking experiments that would illustrate a distinction, if any between the process as claimed in the patent in suit and the practice of steelmaking under the Schwarz and Miles teachings of deep penetration. However, plaintiffs admittedly failed to come forward with evidence of any such experiments."

The plaintiffs here assert that the District Court "overlooked its earlier discussion of the June, 1949 tests (pp. 410-15) which, as the Court pointed out, demonstrated that the patentees' process was a different and more successful process than had been practiced or disclosed by Dr. Durrer and Dr. Hellbruegge, whose practices were the same as Schwarz and Miles and involved the deep blowing of both Schwarz and Miles." (Statement for Plaintiffs on the Issue of Collateral Estoppel, at page 48).

Not only was this true, but the plaintiffs here did not point out the fact that the *McLouth* District Court misinterpreted the testimony of witnesses relating to the June 1949 Linz tests, by attributing statements made in this testimony to the Suess patent itself, when in fact such testimony did not even mention the Suess patent.

[286] The District Court Opinion discussed the tests conducted by the applicants during June 1949 at Linz, Austria, and attributed "the new concept, the new mental approach" to the testimony of Drs. Suess, Rinesch, Trenkler and Hauttmann, the inventors, (R. 13,184-13,187) (257 F.Supp. at page 410), and further, projected this to "the concept of a reduced impact pressure of the jet on the bath so as to avoid deep penetration" (257 F.Supp. at pages 410-419). Starting with the first, the District Court Opinion stated, "Indeed, Dr. Trenkler testified (R. 11,905) that the avoidance of deep blowing in the process at Linz was the only difference from the process of deep blowing at Gerlafingen." (257 F.Supp. at page 410). At another time the District Court Opinion said, "In like manner, Dr. Hauttmann testified that the

only changes in operating procedure made by the patentees from the June 17th tests following Dr. Durrer's teachings to the June 25th tests following the patentees' own ideas, were the change from the Laval nozzle to a normal cylindrical nozzle and an increase in the nozzle bath distance from 10 centimeters to 15 centimeters (R.2665,2246,2256)." (257 F.Supp. at page 410).

This statement in the Opinion, as I have researched it, is accurate, but only so far as it goes. By itself the statement would seem to be non-critical, but when this was associated with the inventors' "method" and with a follow-up excerpt of similar admissions at the final argument, it became critical, because by these observations the District Court seemed to be laying the [287] foundation for its eventual finding that "avoidance of deep penetration was the gist if the invention." Thus the plaintiffs' contention that both *McLouth* Courts failed "to grasp the technical aspects of the case and the real issues involved," might well have some partial foundation in the misconception and misinterpretation that the only differences between the prior art and the *patent* (and not the June 25th Linz tests) was in "the change from the Laval nozzle to a normal cylindrical nozzle and an increase to the nozzle bath distance from 10 centimeters to 15 centimeters." The follow-up excerpt from the District Court Opinion reads as follows:

> "*Plaintiffs also admitted on final arguments* that the only mechanical changes in method from the teaching and disclosures of Dr. Durrer and Dr. Hellbruegge were the change from a Laval to a normal nozzle and an increase in the nozzle bath distance. (R. 13,183-13,-187)." (Emphasis added) (257 F.Supp. at page 410).

This statement is taken out of context.

While there were statements made by counsel for the plaintiffs by which, in their isolation, such a conclusion or such conclusions could be drawn, an examination of that portion of the final argument dealing with this phase, on

the whole, presents a truer picture. But I shall first point out that this segment of the testimony from which these various excerpts were taken dealt with the exprimentation of Dr. Durrer and Dr. Hellbruegge at Gerlafingen, Switzerland, and of what the [288] difference was between the Swiss experiments and the Linz experiments during June 1949, as related to two (actually three) different kinds of tests.

This test was started with a blowing pressure of 7 atu at 15 centimeters distance from the bath. However, because a heavy discharge occurred during decarbonization, the oxygen pressure was reduced to 4 atu. Other difficulties arose but most particularly a turbulent boiling motion occurred which produced foam. As a result of this the experimenters conducted test No. 4 with an attempt to eliminate the difficulties which had resulted in test No. 3. In test No. 4 they raised the pressure to 8 atu and reduced the distance of the nozzle from the bath to 10 centimeters (PX-K-12-B p. 1527b- M DX 26-B). However, from the results obtained from the third test on June 9th, the experimenters conceived the idea that greater nozzle to bath distance and lower pressure and flow rate were called for (PX-J-7 pp. 2231-32).

In the meantime a series of four tests, Nos. 5-8 were conducted. With what they had learned, particularly from the June 9th tests, they planned a two-series experimentation, one based upon the old concept of deep penetration, and the second, in accordance with the new concept of increased nozzle to bath distance and lower pressure and flow rate.

Although they started to carry out a series of tests, Nos. 15-19 on June 22nd, in accordance with what they conceived [289] to be the new concept, these apparently failed because of badly damaged refractory linings, and so these were stopped. The refractories were renewed and the "new concept" was tried out on June 25th, 26th and 27th, with four tests on the 25th, Nos. 20-23; four on the 6th, Nos. 24-27; and

three on the 27th, Nos. 28-30. (PX-K-12B p. 1581b - M DX-116).

While the tests carried out on June 25th, 26th and 27th demonstrated that satisfactory results could be obtained (PX-J-8 pp. 2249-50; J-35 pp. 11,899-904), it will be observed only in tests Nos. 2 and 3 and in tests Nos. 20-30 inclusive on June 25th, 26th and 27th was satisfactory steel produced. Yet, in none of these was there any claim that the steel was of a quality equal to that produced in the open-hearth.

In any event, as I said before, when Dr. Hauttmann and Dr. Trenkler testified to the differences between the prior art and of that experimentation which had been carried on at Gerlafingen, the statement was that the only difference was from a Laval to a regular nozzle and by increasing the nozzle-bath distance from 8-10 centimeters to 15 centimeters.

In examining all of the testimony here, it is noticeable that other distinctions were incorporated in the evidence, as these became eventually a part of the specification teachings in the patent applications filed in the United States Patent Office. **[290]** These were different from the prior art of Schwarz and Miles who relied on a more or less horizontal nozzle entering the bath; the Gerlafingen experimenters relied upon a bent lance, but the Linz experimenters through the June 27th tests designed and used a straight water-cooled lance entering through the top opening (PX-J-7 pp. 2225-28; J-35 pp. 11861-62; J-36 pp. 11932-33).[46] The nozzle was inserted from the top center and as the vessel was straightened, it was approximately vertical and approximately centrally injected (PX-J-7 p. 2225, PX-K-12-B p. 1530b M DX-26B). Also, the difference in pressure was not noticeably observed at this time and after the June 27th tests, both the difference of nozzle use as well as height

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[46] Laval nozzle on June 17th only and changed to cylindrical nozzle on June 25th, 1959 (PX-J-7 p. 2246). (PX-K-12-B p. 1581b-M DX-116 shows normal nozzle used from June 22nd on.

from the bath were disregarded by the experimenters in their remaining tests, which included a total of approximately 250 by the end of November 1950. By reason of all of these tests up to November 1950, neither differences as they were emphasized as differences between the prior art and the experimentations carried on through June 27th bore any materiality or relevance with the specifications prescribed in the patent applications as they were presented to the United States Patent Office.

[291] The testimony of Dr. Rinesch, Dr. Trenkler and Dr. Hauttmann came to the *McLouth* District Court by way of interpreters and on occasion misunderstanding and misinterpretations became obvious. However, one fact is clear. On one of the occasions when clarification was necessary, Dr. Hauttmann did make an out-and-out assertion which was evidently lost to the recollection of the District Court. That statement was (PX-J-9 p. 2658), "I was talking about the tests rather than about the distinction between the patent and the prior art." This is important, because while the District Court attributed statements to Dr. Hauttmann and Dr. Trenkler to the effect that the only differences between the prior art and the experiments of June 25th at Linz were in the change of a regular nozzle to a Laval nozzle and of increasing the distance from 10 centimeters to 15 centimeters, it is obvious that Dr. Hauttmann did inform the District Court that he "was talking about the tests rather than about the distinction between the patent and the prior art."

From all of this it is evident that the District Court attempted to extrapolate from the testimony, particularly the testimony of Drs. Trenkler and Hauttmann, the differences between the Gerlafingen experiments and the June 17th and June 25th 1959 Linz tests, and the patent itself. Dr. Hauttmann [292] made it plain that in his testimony he was talking about the differences in the two series of tests and not between the patent and the prior art. The

question now is whether or not the District Court extrapolated this difference from the June 17th and June 25th tests to the findings that the invention lay in the reduction of impact pressure by the jet on the molten metal bath.

However, in connection with the testimony of Dr. Hauttmann, particularly I should point out two possible misconceptions which may have occurred on what might both be technical and legal bases. When Dr. Hauttmann was asked whether the nozzle should be a Laval type or normal or cylindrical type, he answered (PX-J-9 p. 2754): "Any type can be used." And the District Court (PX-J-9 p. 2565) asked Dr. Hauttmann whether there were any other departures from the prior art with respect to the patent in suit other than the two talked about, and the answer was "Yes . . . That is the production of a hot reaction field in the middle of the upper bath region." The District Court interrupted "Wait a minute now. We are not talking about the results obtained, but we are talking about the methods used. That is what my question is directed to." And the witness replied, "That is the non-deep penetration of the bath." Counsel for the defendant suggested "That still is the result, if it please, your Honor." The Court replied "Well, it may be. . . ." (PX-J-9 pp. 2656-57).

[293] That brings us to the interesting and critical question of whether "avoidance of deep penetration" is in reality a method as required by the statute or the result of the method. Since we deal here with a process, we may conclude that that process is "operative" if it produces its intended results. *Application of Ruskin*, 345 F.2d 395, C.C.P.A. 1966. The result the patent is intended to produce is not "avoidance of deep penetration" but rather a successful refining of molten iron into steel by means of applying high purity oxygen onto the surface of the molten metal bath (col. 12, lines 10-16 and col. 2, lines 36-44). A patent does not issue when it is based on results alone. *In re Lamnchen*, 112 F.2d 817, C.C.P.A. 1940. Thus if "avoidance of deep penetra-

tion" is a result, it is not patentable. It is the distinctive means or method for accomplishing results which is patentable. *Mervin Glass & Associates* v. *Sears, Roebuck & Co.*, 318 F.Supp. 1018 (D.C. Tex., 1970) *aff'd.* in part 448 F.2d 60, C.A. 5, 1971. The law is clear that there is no patent on result. A patent is awarded for the distinctive means or method of accomplishing the result. *Jenkins Metal Shops, Inc.* v. *Pneumafil Corp.*, 303 F. Supp. 653 (D.C.N.C., 1969), *aff'd.* 427 F.2d 144, C.A. 4, 1970. The law is well settled that the end or purpose sought to be accomplished by the device is not the subject of the patent. The invention **[294]** covered thereby must consist of new and useful means of obtaining that end. *Knapp* v. *Morass*, 150 U.S. 221 227 (1893).

Is the adjustment of a nozzle or changing its character so as to produce a lesser impact pressure of the oxygen upon the metal bath, a cause and is the lesser impact pressure thereby produced, a result? And if a lesser impact pressure produces avoidance of deep penetration, is lessening of impract pressure the gist of such an action, or is its productive result, avoidance of deep penetration, the gist of the action? If the lesser impact pressure does not damage the bottom refractory because the oxygen is not blown deeply enough, is the avoidance of deep penetration a cause and the avoidance of injury to the bottom refractory a result? If the lessening of the impact pressure permits more iron oxide to enter into the slag to refine the sulfur and phosphorus, is that the gist of the invention, or is avoidance of deep penetration the gist of the invention? Or are all of these mutually correlated steps for producing the ultimate result of obtaining steel by the use of the oxygen application?

Carrying this thinking still further, are these heretofore mentioned steps the total component parts of producing the results of obtaining steel from iron by the application of oxygen? **[295]** Or are there others, and if there are others, what are they? If there are other steps or mutual,

correlated ingredients are they not altogether to be considered as the "method" concerning which the patent statute speaks? Under such circumstances, all of these together in combination would be the cause of the ultimate result of obtaining steel from iron by the use of oxygen.

Because all of this, in the way of intermediate results, seems to be interconnected with the District Court's extrapolation of the two differences in mechanical application from the June 17th tests to the June 25th tests and the final patent, it is appropriate at this time to discuss the District Court's finding that "however, the patentees must be credited with the invention under applicable patent law, because they took the final step of reducing impact pressure so as to avoid refractory damage and to create the early fluid slag necessary for satisfactory phosphorus removal. . . . Yet this final step of reducing impact pressure was the difference between success and failure." (257 F.Supp. at page 419). Thus it would seem that the "final step" was considered by the District Court to be in effect the invention. Under these circumstances, then, the June 25th series of experiments by Suess at Linz finalized the invention, and it would further seem that the balance of 250 tests which ran up until November, 1950 contributed nothing more to the [296] invention—or to the patent. However, there is one serious difficulty with this thinking, and that is that the patent as granted in 1956 by the United States Patent Office does not recognize the invention to be "a reduction in impact pressure" (257 F.Supp. at page 425).

There was considerable confusion in the questions asked of both Drs. Hauttmann and Trenkler, but particularly Dr. Trenkler, and oftentimes inferences were ambiguously contained in both the questions and answers. These witnesses were hard to follow, particularly as they indicated that there were different nuances for words in German which did not exist in English. My inquiry was in attempting to resolve the plaintiffs' various contentions

that the District Court failed to grasp the technical facts or misconceived and mis-interpreted the testimony. This is perhaps exemplified in a portion of the questions and answers comprising the testimony of Dr. Trenkler. It begins with the question on cross-examination (PX-J-35 p. 11,899):

> "(By Mr. Groner, continuing) . . . In your work in Linz in the summer of 1949, when was the first time, according to your theory, when you did something that differed from what Dr. Durrer and Dr. Hellbruegge had taught you?"

Here we see a specific question pointed to the June 1949 tests, and yet as these questions and answers meander through at least the next seven pages, they refer to what might seemingly be [297] ambiguous references to the Suess et al. patent specification itself, but from a close examination of all of these it is obvious that the witness was speaking about the difference in their June 1949 tests from that of the prior art, but particularly of that practiced by Durrer and Hellbruegge at Gerlafingen. It is significant that the District Court was formulating conceptions based on cause and effect in line with applicable legal principles all on the prior art, and what would amount to the completed patent specification as exemplified in the June 25th, 26th and 27th, 1949 tests. Throughout all of this the District Court was searching for method, as it properly should, rather than for what the method produced. And when the witness answered, "There are no other differences," the District Court had apparently arrived at the conclusion that Dr. Trenkler spoke of the Suess et al. patent, and this in spite of the fact that the Suess patent specification as filed in the United States Patent Office was never mentioned.

My inquiry led me into a question of whether or not the defendant's counsel, throughout the trial in his cross-examination of the plaintiffs' experts, did or did not provide

grounds for misleading the District Court on the technical facts and issues as they occurred. Mr. Groner, counsel for the defendant, was a highly skilled, and most especially persistent cross-examiner. This at times created a state of confusion of the facts themselves.

[298] In spite of the high skill of the plaintiffs' Massachusetts Insitute of Technology experts, I have observed frequently their submission to the cross-examination rather than to an out-and-out declaration of the scientific facts. With interpreters as intermediaries between the German witnesses, Dr. Trenkler and Dr. Hauttmann, it at times became difficult for clarification of Mr. Groner's cross-examination as it related to the two differences between the June 17th Linz tests (and Gerlafingen experimentation) and the June 25th Linz tests (referred to as the "new concept"), I observed the efforts of the cross-examiner to tie in this difference with the present day practice of the Suess "method" and this I observed to be a skillful maneuver on the part of the cross-examiner to tie this in with the McLouth defense that at McLouth the prior art of Schwarz, Miles and Gerlafingen were practiced in their OP-1 and OP-2 operations.

There were objections on the part of the plaintiffs' counsel but somehow or other the information elicited by cross-examination found its way into the evidence. As for instance, Dr. Trenkler in direct testimony testified only to the visit which he made to Gerlafingen, Switzerland and the contact he made with Dr. Durrer and Dr. Hellbruegge at a May 1949 meeting.

[299] Mr. Groner asked (PX-J-35 p. 11,881) about two tests at Linz on May 9th. Mr. Webb objected to this as going beyond the scope of direct examination because no questions were asked of the witness regarding the Suess Linz tests in June 1949. A long debate occurred on the question. At one time Mr. Groner said (PX-J-35 p. 11,884):

"I will show your Honor, if I am allowed to, that they —when I say 'they' I mean Dr. Trenkler and his associates at Linz—equated the teaching of Dr. Durrer and Dr. Hellbruegge on the one hand with that of the German Schwarz patent on the other, and, further, that they thought for a long time that they were operating under the Schwarz patent."

The objection of Mr. Webb was further emphasized and argued (PX-J-35 p. 11,886). In the end, however, the Court allowed the question to be asked and answered as it related to the two tests held in June 1949 at Linz. However, when the cross examiner asked (PX-J-35 pp. 11,893-94):

"Those two tests of June 9 which you say were successful were run according to the teachings of Drs. Durrer and Hellbruegge, weren't they, Dr. Trenkler?,"

Dr. Trenkler's answer was:

"No, not quite."

He then explained further (PX-J-35 p. 11,894)

"First, test No. 4 had an essentially smaller oxygen impact pressure, that is, an oxygen pressure and a higher nozzle-bath distance, and this is shown in my report dated June 10 in the fourth paragraph, and in the fourth test, as I see only now, a normal nozzle and not a Laval nozzle was used."

[300] And further, (PX-J-35 p. 11,894)

"Q. Did Dr. Durrer or Dr. Hellbruegge teach you that you had to use a particular oxygen pressure and nothing else?

A. I believe I have already explained exactly the teaching of Dr. Durrer and Dr. Hellbruegge, and I am going to do it once more.

Q. Thank you, Doctor.

A. Their opinion and their teaching is that the oxygen jet has to penetrate into the lower regions of the bath so that a corresponding bath movement by the oxygen stream will be insured and a low iron content of the slag can be obtained.

Q. Now, Doctor, I am going to ask you my question over again. Did Dr. Durrer and Dr. Hellbruegge tell you that you had to use a single particular kind of oxygen pressure and no other kind?

A. No."

With the door thus opened the cross-examination led into information which indicated that a regular nozzle was first used in Test No. 3 and that a Laval nozzle was used in Test No. 4, on June 9th. Also the testimony indicates that a 15 centimeter height from the bath depth was used on June 9th rather than on June 25th. This, of course, creates a certain amount of confusion between whether or not the two differences actually occurred between June 17th series of tests and the June 25th series of tests, since Dr. Trenkler testified that the change first occurred on June 9th with Test No. 3.

[301] However, it was also indicated that on the basis of the difference of the tests in Test Nos. 3 and 4 on June 9th, a plan for future testing was eventually devised. What is significant here is that a misconception or misinterpretation occurred by which the District Court was led into accepting the real difference from the prior art of Schwarz, Miles and Gerlafingen, and the Suess Patent process lay in the discovery by the Suess experimenters at Linz that the only two differences from Gerlafingen and the patent itself or the method in the patent itself, was in the change of the nozzle and its height from the surface of the bath. Was this or was this not the basis by which the McLouth District Court arrived at its finding,

"Further, plaintiffs in this litigation have repeatedly contended that the 'new mental concept' that differ-

entiates the invention of the patentees from the prior art Schwarz and Miles patents, and also the teachings of Dr. Durrer and Dr. Hellbruegge, was a reduction in impact pressure so as to avoid the deep penetration suggested by the prior teachings." (257 F.Supp. at page 425).

And it further found,

". . . this final step of reducing impact pressure was the difference between success and failure." (257 F. Supp. at page 419)

And,

"However, the patentees must be credited with the invention under applicable law, because they took the final step of reducing impact pressure . . ." (257 F. Supp. at page 419).

[302] And,

". . . all four of the patentees at one time or another considered a reduced impact pressure of the jet on the bath or the avoidance of a deep penetration of the bath by the jet to be the gist of the invention." (257 F.Supp. at page 424).

Thus it is that the District Court did not correlate and differentiate the method of the June 1949 Suess experimentation, but rather correlated the Suess patent specification and the Gerlafingen experiments and arrived at the conclusion that the only difference was one of "lower impact pressure" (257 F.Supp. at page 425).

That the District Court correlated these two changes in the early experimentation by the Austrians, and the eventual invention and patent itself, is borne out by various parts of the District Court's Opinion. When discussing the achievements of Dr. Durrer and Dr. Hellbruegge at Gerlafingen and the assertion that the plaintiffs contended that they did not get a disclosure from Gerlafingen of "the

concept of a reduced impact pressure of the jet on the bath so as to avoid deep penetration," the Court concluded that according to the plaintiffs, "avoidance of deep penetration" is "the new concept, the new mental approach of the patentees." It also concluded that "Whether such a reduction in penetration by the patentees should be considered significant *for patent purposes* could only be determined by a comparison of the actual results achieved by the tests at **[303]** Gerlafingen and Linz." (Emphasis added). (257 F.Supp. at page 410).

The Court thereafter discussed the quality of production at Gerlafingen and compared this with the so-called "better quality" of production in the Linz June 25th tests, and found,

> "The striking disparities in the results of these three series of tests [at Linz] appears to this Court to be attributable solely to differences of impact pressures caused by the variation in the type of nozzle used or nozzle bath distance, or both." (257 F.Supp. at pages 411-412).

The Opinion also states that,

> "This difference in result is apparently explained by a different order of chemical reaction, when deep penetration was avoided." (257 F.Supp. at page 414).

The Opinion continues with the statement that Dr. Trenkler had achieved "better dephosphorization [which] . . . indicates strongly an entirely different steelmaking process taking place in the Linz June 25th series of tests than at Gerlafingen, despite a seemingly minor change in the operating procedures." (257 F.Supp. at page 414). The Opinion says,

> ". . . the June 25th tests at Linz represented a different and more successful process than had been practiced and disclosed by Dr. Durrer and Dr. Hellbruegge . . . involving a relatively low impact pressure of the

jet on the bath as opposed to the recommendation of Dr. Durrer and Dr. Hellbruegge . . ." (257 F.Supp. at page 415)

In the conclusion the Opinion states,

[304] "In the opinion of this Court, a preponderance of the evidence establishes that the patentees rather than Dr. Durrer and Dr. Hellbruegge were, in fact, the true inventors of the subject matter of the patent in suit." (257 F.Supp. at page 418).

Such Opinion excerpts reveal two facts: first, that the District Court confined its considerations only to the change of nozzle and change of nozzle height in the Linz June 25th series of tests; and second, that it based its finding that the Suess process (as revealed in the Linz June tests) was based on these two changes in the June 25th tests.

From the testimony of Dr. Hauttmann and Dr. Trenkler it would seem that no foundational support was laid for the findings that "lowering of impact pressure" was the invention, because of avoiding deep penetration which was the "gist of the invention."

In a third reference (PX-J-39 pp. 13,184-87) (257 F. Supp. at page 410), that the "Plaintiffs also admitted on final arguments that the only mechanical changes in method from the teachings and disclosures of Dr. Durrer and Dr. Hellbruegge were the change from a Laval to a normal nozzle and an increase in the nozzle bath distance." Since we are still on the question of whether or not "lowering of impact pressure" is the one concept of the Suess invention, and as such "the gist of the invention" because it results in the "avoidance of deep penetration," I am bound to pursue my inquiry into the third point discussed in the District Court Opinion on this related topic.

[305] While Drs. Hauttmann and Trenkler testified that the two main physical or mechanical differences in the early Suess tests at Linz were a change of Laval nozzle

for a regular nozzle and heightening it, there was no support for the District Court's findings that it was the invention for which the patentees made application in the United States Patent Office, and upon which application a patent was eventually granted.

On the other hand such testimony is supportive of the fact that the idea had come to these Linz experimenters that the prior art, including that at Gerlafingen, was not the route by which they should travel in order to get the results which the Gerlafingen experimenters failed to get. And so it was, as the testimony of Drs. Hauttmann and Trenkler showed, that the problem which had not yet been solved in the early Linz tests, required 200 or more tests before it could become an industrial process for the successful conversion of iron into steel.

From my inquiry into all of this testimony, it is obvious to me that the testimony of Drs. Trenkler and Hauttmann was not supportive of the District Court's finding that there were only two mechanical changes from the prior art practiced at Gerlafingen; that such testimony was misinterpreted and misapplied, and that this occurred without any fault on the part of the plaintiffs.

[306] XVI. The Plaintiffs' Final Argument

The District Court Opinion states "Plaintiffs also admitted on final arguments that the only mechanical changes in method from the teachings and disclosures of Dr. Durrer and Dr. Hellbruegge were the change from a Laval to a normal nozzle and an increase in the nozzle bath distance (R. 13,184-13,187.)" (257 F.Supp. at page 410). This statement in the Opinion is highly critical because if true, it reveals an understanding to the District Court's conclusion that reduced impact pressure of the jet upon the bath was the avoidance of deep penetration and so the gist of the invention.

In the final arguement to which the District Court Opinion alludes there was considerable discussion in this regard. The change from the Laval to a normal nozzle and an increase in the nozzle bath distance from 10 centimeters to 15 centimeters was fully discussed in the testimony of Dr. Hauttmann and Dr. Trenkler. As I review the final argument and the colloquies between counsel and the District Court, I find some ground for the conclusion of the District Court, as well as some criticism against the plaintiffs' counsel for his failure to better clarify these particular technicalities. Some specific [307] reference to the final argument will exemplify this (PX-J-39 p. 13,186):

> "THE COURT: Yes, but whatever you call it, the only things they actually did, the only mechanical things—put it that way—the only mechanical differences, as I see it, according to their statements, was the change of the nozzle, type of nozzle and the change of the blowing height.
>
> [Counsel for Plaintiffs]: Those are the mechanical things which they did, your Honor.
>
> THE COURT: Is there anything else they did, any other mechanical thing they did?
>
> [Counsel for Plaintiffs]: No, I think that was it, your Honor, so far as the mechanical changes they made are concerned, yes. It was to utilize a nozzle in this work which would give them this *low impact pressure at the surface* . . ." (Emphasis added)

At (PX-J-39 p. 13,189):

> "[Counsel for Plaintiffs]: . . . So what they did, the physical things that they did, was to pull the lance up and also use the normal nozzle for some of their test work. And when they did those two things, they realized then for the first time that this was the way to do it."

Up to here references were entirely to the June 25th series of tests at Linz.

At (PX-J-39 p. 13,208):

"THE COURT: . . . its your position, . . . that this new concept arose as a result of this accident, and therefore they changed their blowing methods. They used a different nozzle or they changed the [308] blowing distance.

[Counsel for Plaintiffs]: Yes."

(PX-J-39 p. 13,225):

"THE COURT: They taught *deep blowing* and the *Suess* patent here teaches blowing that is not deep.

[Counsel for Plaintiffs]: That's right, your Honor.

THE COURT: That is the main *difference.*

[Counsel for Plaintiffs]: Yes, your Honor. That is the main *difference* . . ." (Emphasis added)

Here we see that the District Court introduced the "Suess patent", where before in the testimony of Dr. Trenkler and Dr. Hauttmann, the "deep blowing" "difference" was in relation to the difference of the June 25th tests from those on June 17th, only as their "new concept" became different from that of the accepted prior art.

If we were to stop here, I would have to agree with the District Court that the testimony of Drs. Trenkler and Hauttmann, as well as plaintiffs' admissions, presented supports for the District Court's eventual holding that the only two changes from the prior art to the patent specification itself lay in the change of a Laval nozzle to a normal nozzle and an increase [309] in the nozzle bath distance from 10 centimeters to 15 centimeters.

However, I cannot stop here because of two facts: first, the District Court disregarded many tests which were conducted by the Suess patentees after June 27th, and prior to filing the application; and second, that much of what counsel for the plaintiffs had said and was trying to say

about the patent itself is revealing. We know by looking at the Suess et al. specification that these two so-called changes between the prior art and the June 25th tests were not incorporated in the Suess applications filed in the United States Patent Office. Throughout final argument by plaintiff's counsel, there were many attempts to clarify that point. Counsel's earlier efforts are illustrative (PX-J-39 p. 13,212):

> [Counsel for plaintiffs]: I want to make myself clear on this matter of the new mental concept. I'm not suggesting, your Honor, that we have here a patent on just a mental concept, because what we have is a process patent. We have in the specification description of the process, and we have in the claims a statement of the considerations, the guidelines, the steps that have to be carried out in order to accomplish the results sought by the inventors."

At another time the plaintiffs' counsel (PX-J-39 pp. 13,193-13,194) referred to testimony of Dr. Hauttmann when the question was asked of the witness on what the two changes taught **[310]** regarding the old and the new principles involved, the answer was:

> " 'They taught us to think quite differently—completely differently—from the way the others thought who were active in that field. They taught us a different, entirely new concept. They taught us the following in detail:
>
> First, the necessity to avoid a deep penetration of the oxygen jet into the bath. There is no need to produce the bath circulation by the mechanical action of the oxygen jet. The bath movement should not be caused by the mechanical action of the oxygen jet but by the chemical reactions which take place. And third, the desirability of creating a hot spot—that is, a highly reactive zone—in the central portion of the surface of the bath and in the upper region of the bath which is spaced from the refractory lining of the vessel—that is from the walls and from the bottom.' "

In this reference we see two highly critical factors involved. First, blowing into the central portion of the bath, and secondly, at the surface in the upper region of the bath. Counsel for the plaintiffs attempted to impress upon the District Court the fact that (PX-J-39 pp. 13,213, 13,214), the new concept included the physical necessity of the "lowering of the impact pressure of the jet on the metal bath". They at the same time attempted to explain that this one phase of the [311] concept not only created an extremely high temperature—localized reaction zone, but it provided that which the prior art did not have, protection against the "burning" of the refractories. At the same time the process eliminated the phosphorus contrary to the results of the prior art.

There was also an attempt to clarify the statement of what the impact pressure meant. For instance plaintiffs' counsel was saying (PX-J-39 pp. 13,215-13,217):

> ". . . I think that there is quite a bit to this mental concept, far beyond this mere matter of just raising the lance, although, as I stated before, there is no question but what that is the thing which the inventors did which caused them to get this new method of blowing, this new concept.
>
> THE COURT: That would be the process then, changing the lance.
>
> [Counsel for plaintiffs]: No, the process is not the changing of the lance. The process is blowing with the low impact pressure or blowing in such a way as to avoid material agitation and so forth *as stated in the patent.*
>
> THE COURT: Getting back to Schwarz and Miles here or Durrer and Hellbruegge, the differences here, as I understood, was simply the blowing, the method of blowing, that could be done either by changing the type of nozzle or increasing the blowing distance, or both. That would be the process, and the other things would result from that, wouldn't they?

[312] "[Counsel for plaintiffs]: No, I don't think so, your Honor.

THE COURT: It is not enough just to say you are going to blow so to avoid all these things if you don't teach how to do it. You have to teach these steps.

[Counsel for plaintiffs]: *That is what the specification is for, and that is what the specification does.*" (Emphasis added)

Thus we see here an effort on the part of counsel to guide the District Court into the patent specification itself and away from the June 25th series of tests at Linz. If the District Court had differentiated these June 25th tests from what was finally instructed in the specification of the patent as filed in the United States Patent Office, there should have been no misunderstanding.

When counsel for the plaintiffs was questioned concerning defining structural limitations and not merely result, this colloquy occurred (PX-J-39 pp. 13,218-13,219):

THE COURT: But I was asking you that question in terms of this case, if in fact that is not the situation here, rather than set forth the method.

[Counsel for plaintiffs]: No. I think that the claim sets forth the method, your Honor. And I think that how to do it, within the broad considerations, the broad principles specified in the claim, the specification tells everybody in the art just what to do."

[313] With another of the District Court's questions, counsel seemed again to persist in his contention that the specification of the Suess et al. patent contained the necessary instructions to perform the Suess process. (PX-J-39 p. 13,219):

THE COURT: Where is that set forth in the specification, that the idea was to control the impact pressure? Does the patent teach that?

[Counsel for plaintiff]: Well I think that—

THE COURT (interposing). In other words, the avoidance of deep penetration was to avoid too much impact pressure?

[Counsel for plaintiffs]: I am not sure that that exact language is employed in the patent, your Honor.

THE COURT: As I understand, that is your claim now, that that is the new concept. The avoidance of excessive impact pressure."

Here was an indication that the District Court was impressed with a synonymity of the terms "avoidance of deep penetration" and avoidance of "to much impact pressure." And when the District Court put the point directly to counsel, it was not clarified as skillfully as counsel was capable of doing. However, he did not fail altogether because he said (PX-J-39 p. 13,220):

[314] "Well, I certainly think that it does teach how to do that, your Honor, because it sets forth examples to be followed and it sets forth exemplary commercial practice, and if you do that you avoid the deep penetration. That is the teaching of the patent."

The Court thereafter asked whether or not it taught how to do it with other sized heats, and plaintiffs' counsel replied (PX-J-39 pp. 13,220-13,221):

"Yes, I think it does. I think the evidence before your Honor is very clear on that point, because we have the testimony first of Dr. Chipman on the point; we have the testimony of Mr. Prince; we have——

THE COURT: (Interposing) I know, but don't you have to find that from the teaching in the specification? Not from the testimony, do you?

[Counsel for plaintiffs]: Well, the question is whether or not the specification teaches those skilled in the art.

THE COURT: That is true.

[Counsel for plaintiffs]: And we have those . . ."

However, eventually the District Court did make a finding that the patent teaching was clearly enough enunciated so

as to permit persons skilled in the art of steelmaking to extrapolate the instructions to other size vessels. (257 F.Supp. at page 442)

At another time counsel for the plaintiffs said (PX-J-39 p. 13,223):

[315] ". . . I say here that the mental conception of the method of operation is the important feature, and that that mental conception, which is *reduced to the process steps* which are set forth in the claims, is the thing which resulted is a new mode of operation which has brought about these important and far-reaching consequences." (Emphasis added)

After that there are references by which counsel attempted to emphasize the difference in the prior patents from that of Suess. As for instance (PX-J-39 pp. 13,223-13,224) in the prior art he said the teachings were to use deep penetration of the bath by the oxygen stream for the purpose of stirring the bath. Whereas in Suess, the teaching was to create a localized reaction zone.

When the District Court gave plaintiffs' counsel an excellent opportunity to expound on all the causes or factors which contributed or might have contributed to the stirring of the bath, as in the prior art of Schwarz and Miles, as the plaintiffs' counsel had argued, he obligingly submitted that "deep blowing", as the District Court had limitedly rephrased his term "stirring the bath" was the "primary things". Here in this opportunity afforded him, he might have indicated that angular blowing would have stirred the bath pressure outside the limits instructed in the specification, whether above or [316] below the figures and dimensions indicated there; that a non-central blow would have stirred the bath and failure to observe the ratio of bath depth to area surface blowing might have stirred the bath—and so on.

Although we must remember that counsel for the plaintiffs did bring these matters out one factor at a time, he now

added the new factor "the teaching of the localized reaction zone".

With the interchange of these comments relating to deep blowing and other factors, I am at a loss to understand why counsel for the plaintiffs and the District Court were moving in diverse directions. Perhaps counsel for the plaintiffs, in reality, failed to take advantage of these various opportunities to present in graphic language, lucidly and amply, all of these technical factors as a whole. Rather, it appears that he presented the elements narrowly and one step at a time. If plaintiffs' counsel did this it would be most difficult for a trial judge not skilled in the specific art to interconnect the various factors and view them as a single entity.

While I have already excerpted portions of the District Court Opinion showing the conclusions made by the District Court as relates to the term "localized reaction zone" and as such were or might have been related to the work of Schwarz and Miles, [317] we see in what follows that counsel for the plaintiffs was unable to clarify the point for the District Judge (PX-J-39 p. 13,225):

> THE COURT: They taught deep blowing and the Suess patent here teaches blowing that is not deep.
>
> [Counsel for plaintiffs]: That's right, your Honor.
>
> THE COURT: That is the *main difference.*
>
> [Counsel for plaintiffs]: Yes, your Honor. That is the *main difference.* And, as I said before, in the Patent in suit *we go further and point out the necessity for this localized reaction zone* which is not talked about at all or discussed by Schwarz or Miles. I think that that can properly be considered as *another* distinction.
>
> THE COURT: It comes about as the result of *changing* the blowing from deep to something other than deep, doesn't it?" (Emphasis added)

Thus it is apparent that the District Court did not vary in its belief that the scope of the invention was the "avoidance of deep penetration".

The plaintiffs' counsel was again given the opportunity to state whether deep blowing was "the main difference", but he said it was. Here again he failed to explain the full circumstances or factors as they were differentiated in the word "main." However, he did relate this concept to the "localized [318] reaction zone" as a necessity of the Suess process, and further added another distinguishing difference, strict "vertical blowing" which was not anticipated by the Schwarz method, by its permissive angular blowing (PX-J-39 pp. 13,226-13,228):

"[Counsel for plaintiffs]: Well, it may also come about as a result of the change in the method of blowing. I think that Schwarz's essential teaching is to blow angularly. I think that the essential teaching of Miles is to blow in angularly.

THE COURT: In other words, you are saying another difference is that the blowing is non-vertical?

[Counsel for plaintiffs]: That's right.

THE COURT: Vertical blowing——

[Counsel for plaintiffs]: Vertical as distinguished from non-vertical.

THE COURT: That's another distinction, is it?

[Counsel for plaintiffs]: I think so, your Honor.

THE COURT: Where it fails to anticipate?

[Counsel for plaintiffs]: That's right. There is some suggestion in one of the patents that you can blow vertically, but essentially the two patents teach this matter of the angular blowing as distinguished from the vertical b[illegible]wing.

THE COURT: Of course, I think it was Miles did teach it could be anywhere from somewhere like 25 degrees to 90 degrees, as I remember it.

[Counsel for plaintiffs]: That is right. That's why I made the statement that I did, your Honor.

[319] THE COURT: But I think it did recommend something between 30-some degrees and 75, or something like that.

[Counsel for Plaintiffs): That is correct."

Counsel for the plaintiffs again attempted to explain the word "stirring" in the prior art as it was to be prevented or avoided in the Suess process (PX-J-39 pp. 13,227-13,228):

". . . I mentioned in speaking about the difference between Schwarz and the invention in issue that when you deep blow, you stir the bath with the oxygen stream, and that is, I think the definite teaching of both Schwartz and Miles; and we specifically say in the patent in suit that that's not the way to do it. Don't stir the bath with the oxygen stream itself; stir the bath with the chemical reactions.

Now, while you may feel that that is tied in with this deep blowing, I think that it could very well be considered as a separate and distinct differences between what we have——

THE COURT: Well, now, wait. Even if you get deep blowing, as taught by Schwarz and Miles, will that deep blowing nevertheless stir the thing up the wrong way and all that despite the chemical reaction that would be involved?

[Counsel for Plaintiffs]: I'm afraid I can't answer that question, except to say that these patents tell you you have to stir the bath with the oxygen jet.

THE COURT: I know; but, now, as I remember it, Dr. Shapiro, I think it was or maybe Dr. Chipman, made the point that—I think it was Dr. Shapiro—that the chemical reaction would be hundreds of times more powerful than the jet blow.

[320] Now, even if you get this deep penetration by the jet, wouldn't there also necessarily be the chemical reaction involved along with it?

[Counsel for plaintiffs]: There would undoubtedly be some chemical reaction, some stirring from the chemical reaction, but what you might have there if you had this

real combination of chemical stirring and stirring by the oxygen stream I don't know.

But the teaching that we have here is to utilize the chemical reactions for doing that job as distinguished from what these other people said to do—namely, stir by means of the oxygen stream.

So I think that that can properly be said to be another distinction over the teachings of these foreign patents.

Does that answer your Honor's question?"

The District Court was convinced that the Linz experimenters had made only two changes from the prior art, that is, changing the character of the nozzle, and increasing the distance of the nozzle from the bath, all of which amounted to a lessening of the oxygen jet impact pressure upon the surface of the metal bath. As stated:

". . . The striking disparities in the results of these three series of tests appears to this Court to be attributable solely to differences of impact pressures caused by the variation in the type of nozzle used or nozzle bath distance, or both." (257 F.Supp. at pages 411-412)

[321] Considerable other comments were made variously on impact pressure and have been delineated elsewhere. Nevertheless, in spite of the fact that the District Court was inclined towards the conclusion that the sole changes of nozzle character and its heightened placement over the bath surface constituted the gist of the invention as it reduced the jet's impact pressure upon the molten metal bath, it was during the course of the colloquies between the Court and counsel for the plaintiffs, that the District Court, itself, introduced another factor of the Suess specification (PX-J-39 pp. 13,195-13,196):

". . . That was the ratio of the depth-to-surface area"

to which Counsel for Plaintiffs replied:

> "That was an idea that was expressed in the various foreign patents, and it is an idea that was expressed in the original application that was filed."

Here, then, was an additional factor that was brought to the attention of the District Court. Whereupon the District Court asked (PX-J-39 p. 13,196):

> "It is your contention that the concept involved in all of the applications filed by Suess, both in this country and in foreign countries, was this concept, this so-called new concept you have been mentioning here and not just this ratio idea that the defendants have argued? I think that seems to be their position in their belief."

[322] Here, it would seem, the District Court conceived the idea of ratio of bath depth to surface area as something alien and separate from the concept of change of nozzle, and heightening of nozzle for the purpose of lessening "impact pressure", as the gist of the invention. My concern with the final argument concerns whether or not counsel for the plaintiffs met the obligation which was required of him in the representation of his clients? It is apparent to me that the District Court was made aware of factors others than "lessening of impact pressure" as the new concept as of the June 25th series of tests at Linz.

At another time it would seem that counsel again failed because of his reluctance to disagree with the District Court in talking about the procedure in the Patent Office and the changes and modifications of claims as they were originally made (PX-J-39, p. 13,197):

> "THE COURT: Those claims were quite different than any of the prior claims that preceded them over the prior six years.
>
> [Counsel for plaintiffs]: That is quite correct . . . They were *somewhat* different. The limitations in the claims were *different.*" (Emphasis added)

Here we see counsel both agreeing and disagreeing with the District Court. This did not help the plaintiffs' case.

I do not say this in any critical fashion of the person of [323] counsel. I had and have for him, as well as for opposing counsel, the highest respect and a great deal of appreciation for their competence during the trial of the *J & L* cases. They showed the highest qualifications and a gentlemanly demeanor. Such attitudes, however, should not prevent any attorney in the trial of a case from pressing his contentions and clarifying the facts and circumstances of the case. If he fails to do so, he benefits neither his client, nor the trial judge. However, I must consider what counsel said at this final argument in order to determine whether there was any fault on the part of the plaintiffs in guiding the District Court into the finding that "lessening of impact pressure" was the final discovery by the plaintiffs which led to the eventual conclusion by the District Court that "avoidance of deep penetration was the gist of the invention".

When (PX-J-39 pp. 13,198-13,199) the District Court attempted to get information of "any material changes in the specification of the original application as compared with the continuation-in-part application", counsel replied that there were some detailed operating conditions and added "but . . . nothing more than an enlargement of the basic ideas that were fully disclosed in those original—in the original application." [324] The Opinion reflects that the District Court was not aided by this response, because it appears that its "understanding" (PX-J-39 p. 13,195) that the application of Suess in other countries upon which the patents were issued "were based on an entirely different idea" of "ratio of the depth-to-surface area", and that idea was carried into the District Court Opinion as being the basis of the application filed in the United States wherein twelve claims were ". . . directed to a ratio of bath depth to surface area favorable to circulation as the gist of the invention." (257 F.Supp. at page 380).

What I have seen here was a sporadic appearance of some of the essential factors which eventually culminated in

the final application for the patent in the United States Patent Office. Yet it all seems to have been done with a lack of persuasiveness on the District Court's thinking. I continue to ask the question, was this the fault of the plaintiffs, or did the patent itself lack the impressiveness which would entitle it to letters patent? And yet, the patent itself could hardly have lacked impressiveness, because as we have seen the District Court was impressed with the revolutionary quality of the patent (257 F.Supp. at page 441). The fact too was that the District Court regarded this as ". . . . such an outstanding [325] invention" (257 F.Supp. at page 442). I ask then, was the patent in suit of such revolutionary quality and characterization as to be not readily explained, or technically understood? Or, were the two changes made in the early June 1949 tests by the applicants "of reducing impact pressure" non-technical and easily understandable? These questions are in need of answering when, as we have seen, the District Court said ". . . the patentees must be credited with the invention under applicable patent law, because they took the final step *of reducing impact pressure* so as to avoid refractory damage and to create the early fluid slag necessary for satisfactory phosphorus removal." (Emphasis added) (257 F.Supp. at page 419) If it was not of a highly technical character and easily understandable by those skilled in the art of steelmaking, the question then is, why was it of a revolutionary quality, or why should it then be considered "outstanding," and why would Dr. Durrer the oxygen expert of the time in this particular specialized field, say "This work shows a new metallurgy . . ."? (DX-110-E)

And yet going back over the testimony, the District Court was informed by one of the witnesses and again by counsel for the plaintiffs (PX-J-39 p. 13,232) that there was no difference [326] in the nozzle type between the prior art and the patent in suit.

It seems as if the plaintiffs' counsel was trying to make clear to the District Court the difference of what was con-

ceptual to the Linz experimenters in June 1949, and what had become conceptual to them when they filed the application for patent both in Austria and in the United States. That there is an enormously patentable difference between the June 1949 experiments and what was incorporated in the patent applications needs no expertise to detect. I am convinced that the plaintiffs' counsel was trying to make this clear without much success. Here, for instance, are his pointed remarks in that connection (PX-J-39 p. 13,236):

> ". . . You must not forget that this particular art was in an embryonic state at the time that these people wrote some of these things in the early days, because they didn't fully understand the chemistry involved, or at least I don't believe they did.
>
> They did an admirable job, however, when it came to filing their applications and pointing out what this *real new concept was . . .*" (Emphasis added)

For anyone who wishes to know what the subject matter of the Suess et al. patent is, and what its instructions are, the [327] answer lies in the patent specification itself. From this, it is readily apparent that the specification does not contain the words "Laval nozzle" or "heightening the nozzle from the bath surface from 10 centimeters to 15 centimeters". Even in January 1952, the time of the filing of the patent application, the scientific theory by which the Suess et al. patent worked, was not yet understood, even though it was operating. Yet, it was not necessary that it be understood. *Application of Aufhauser,* 390 F.2d 275, C.C.P.A., 1968.

There are many other phases of the colloquies occurring between counsel for the plaintiffs and the District Court which I could point out, as for instance (PX-J-39 p. 13,264) where the District Court asked whether or not there were any teachings or definitions of avoidance of deep penetration in the patent itself, except to avoid burning the bottom, and counsel replied that the principal statement was made

in relation to avoidance of deep penetration. However, that counsel might have pointed to the teaching, not necessarily a short definition, of the specification which would have answered the Court's question in the following reference to patent (col. 3, lines 36-73) and then have pointed out that the specification states that "The process conducted under these conditions avoids a deep [328] penetration of the oxygen gas into the molten bath . . ." (col. 3, lines 73-75) "which seriously impairs refractory life at the *bottom* of the refining vessel." (col. 3, line 75 to col. 4, line 1.) (Emphasis added) And as provided in (col. 4, lines 1-6), "In addition, the impingement area of the high purity oxygen on the central portion of the bath isolates the *refractory walls* of the refining vessel from extremely high temperatures which are developed by the direct reaction of the oxygen and the molten metal". (Emphasis added)

The process is explained to one practicing it that certain chemical actions take place (col. 4, lines 43-67) and then explains that "The oxygen jet thus contacts the emulsion of bath and slag components which presents a larger reaction surface and causes the refining reactions to progress rapidly *although the oxygen jet does not penetrate deeply* into the molten metal bath *and is confined to an impingement area at the* central portion of the bath surface." (col. 4, lines 67-72) This, the steel operator is informed, produces a vigorous boiling action "opposed by the pressure of the oxygen jet *only in the area of impingement*" (col. 4, lines 72-74). So that *the high temperature causing the boiling action of the iron is thus* [329] *confined* because the operator is informed (col. 4, lines 74 to col. 5, lines 1-5) that "outside of this area it represents primarily *endothermic* reduction of FeO by carbon to form the evolved carbon monoxide, which *reaction thus effectively encompasses the zone of direct oxygen reaction at which the highest temperatures prevail affording a maximum measure of protection to the refractory lining* of the refining vessel." (Emphasis

added) It is worth noting that *all* the refractory linings were protected by the Suess process.

So that up to now we have instructions for the method, not necessarily of avoidance of deep penetration but, of conducting the process by means of a nozzle vertically and centrally placed with proper oxygen pressurization, specific diameter nozzle, hemispherical bottom vessel, and ratio within the given limits of the bath depth to surface area.

These teachings which counsel might have pointed out in the specification were much more significant than substituting a regular nozzle for a Laval nozzle, and from heightening the nozzle above the bath. For here we now see specifics and broad ranges and explanations of what, how and why following the teachings produced a high quality finished product, and at the same time preserved the refractory linings.

[330] Plaintiffs' counsel could have referred to the references which comprise the process of the invention (col. 3, lines 16-72) and which contain detailed instructions as to vertical placement, central nozzle control, pressure of oxygen, atmospheres and the like. And further, plaintiffs' counsel might have referred to the instruction in the specification (col. 4, lines 7-25) which instructs upon a suitably designed reaction vessel with attention to ratio of depth of the bath to surface area of the bath.

However, from my inquiries in these matters, I get the distinct impression that the District Court was maintaining that the Suess patent process concerned the limited idea of "avoidance of deep penetration" and that anything vital to the patent should speak of it in those words. And further, that the changes from a Laval to a regular nozzle, and of heightening the distance of the nozzle from the bath, was the "new concept", which eventually became the patent, and therefore the gist of the invention. We are reminded of this as we continue to read the various colloquies with plaintiffs' counsel in this final argument.

As for example (PX-J-39 pp. 13,265-13,266):

"THE COURT: I know. But that isn't taught, is it? Isn't that simply testimony by—who was it? Dr. Elliott?

[331] [Counsel for Plaintiffs]: No, your Honor. It is set forth in the patent where it talking about it at some length in this part appearing, commencing Column 6 of line 5. The importance of this early highly oxiding fluid slag is discussed right there.

THE COURT: I know, but it doesn't speak of that in terms of the avoidance of deep penetration.

[Counsel for Plaintiffs]: No, it doesn't, your Honor.

THE COURT: It says that the process will do that.

[Counsel for Plaintiffs]: That is right. If you avoid deep penetration, then this is one of the things that you are going to get.

THE COURT: Well, it doesn't say that, does it?

[Counsel for Plaintiffs]: I think that is——

THE COURT: (Interposing) It is not in Column 6. What you are referring to there, there is nothing about avoidance of deep penetration to bring about the proper removal of phosphorus and sulphur.

[Counsel for Plaintiffs]: No, your Honor. But I think you have to take all of the statements in context in the patent. That is a part of the teaching of the whole patent. We can't separate the words and paragraphs. I think we have to consider the whole thing in context."

I get the impression here that the District Court was relying less upon what was contained in the Suess et al. patent and more on what it selectively retained from the testimony of the various witnesses. Column 6, line 5 of the patent specification is both informative and instructive to one skilled **[332]** in the art of steelmaking, because it teaches the steelmaker that "formation of an early highly oxidizing fluid slag is of particular value in basic refining when the process is applied . . . in ordinary open-hearth

practice . . ." (col. 6, lines 5-8) It is unnecessary that I cite here the various other portions of the specification which gives a highly elucidating and comprehensive presentation of the process in action. So while the specification tells the steelmaker how his process is functioning, it does not tell him, *in totidem verbis*, to avoid deep penetration, since he will be doing that by just following the instructions in the specification. Thus, the specification does tell him how this intermediate result of avoidance of deep penetration will occur when he operates according to the process.

It is apparent that even though the District Court was embued with the fact at this stage of the case in the final argumen that the "aspects of the invention necessarily follow from avoidance of deep penetration", it is also obvious from a reading of the entire specification that this was fallacious. We see that the specification's teachings of limitations of blowing pressure, vertical and central blowing, together with the other instructions, are abundantly and particularly set out and explained. The law does not demand anything more than this. **[333]** *General Electric Co.* v. *Brenner*, 407 F.2d 1258, (D.C.App., 1968).

In this connection of teachings, I point out also that nowhere in the patent is there any statement that the patent consists of "avoidance of deep penetration of the oxygen jet into the molten metal bath," but that rather, it does state variously that the process avoids deep penetration.

As was set forth by many witnesses, and affirmed by Primary Examiner LeRoy at the first post-trial hearing before me, persons skilled in the art of steelmaking knew that in the prior art deep penetration was a necessity. Four statements contained in the specification relating to the avoidance of deep penetration are nothing more than an assurance to the operator that when he practices the Suess process, he avoids the pitfalls of the prior art.

Nevertheless, the District Court dwelled upon the idea that the change from the prior art from nozzle difference

and higher placement of the nozzle from the bath was the real difference from the prior art, because it avoided deep penetration and was therefore the gist of the invention. If, then, this is fallacious, the question arises, what fault, if any, and to what degree, if any, did counsel for the plaintiffs **[334]** provoke or cause this lack of understanding by the District Court. It is for that reason that I persist in following through in analytical fashion the various colloquies had between the District Court and counsel for the plaintiffs.

From what follows here I get the idea that the District Court was informed several times of the factors comprising the Suess process (PX-J-39 pp. 13,270-13,271):

> "THE COURT: Then it would also follow, I suppose, that all of the other aspects of the invention necessarily follow from the avoidance of deep penetration?
>
> [Counsel for Plaintiffs]: I don't think it can be simplified to that extent, your Honor, because of the possibility that somebody would be able to blow and cause the oxygen jet to cover, we will say, the entire area of the bath. That is not covered by our patent. But I doubt very much that anybody could do that and make good steel.
>
> THE COURT: As I understand it, that is your position, that you can't do that. You have got to blow on the surface and below the surface to some extent.
>
> [Counsel for Plaintiffs]: That's right.
>
> THE COURT: Under the teachings of Suess.
>
> [Counsel for Plaintiffs]: And you have got to create the localized reaction zone, too, your Honor. That is important.
>
> THE COURT: You have to not only create the localized reaction zone, but you have to get below the surface a little.
>
> **[335]** [Counsel for Plaintiffs]: Oh, yes. No question about that. Because you have to have—

THE COURT: (Interposing) If you don't get below the surface you have a soft blow and it boils out, I suppose.

[Counsel for Plaintiffs]: Right. You have got to have good contact between the oxygen jet that is being blown in there and the metal itself. Otherwise you don't get the reactions."

Yet, the recognition of these factors as they are explained in the Suess patent specification was not aided by the advocacy of counsel for the plaintiffs. This was verified in the District Court Opinion when it condemned the phraseology contained in the claim "discharging a stream of oxygen vertically downwardly through the slag layer onto and below the surface of the bath (col. 12, lines 12-14) by stating that, "However, the word 'below' would seem to cover even a deep penetration of the bath by the oxygen stream, which is certainly not taught by the specification." (257 F.Supp. at page 438)

The Opinion would seem to indicate that during the final argument with plaintiffs' counsel, there was a hiatus in the thinking, a gap in the chain of comprehending and understanding what the Suess process was and seemingly a sidetracking to what it was not, i.e., a practically one-step physical manipulation of the oxygen jet so as to lessen impact pressure, **[336]** and procure open hearth quality steel from a blast furnace iron in a short time (col. 2, line 69 to col. 3, line 10), without undue corrosion of the refractory walls. (col. 2, lines 36-44)

By now it seems quite obvious that the District Court was convinced that "avoidance of deep penetration" was the one essential factor it was looking for as being the subject matter of the invention, and as such the essence of the invention which should have been required to have been incorporated in the claim. For that reason it seems that instead of using the word "gist" the District Court used the word "essence". Regrettably, when counsel for the plaintiffs attempted to explain to the District Court that "avoid-

ing material agitation of the bath by the oxygen sream" also "embraces . . . this matter of avoiding deep penetration . . .", he did not seem to be able to make his point since the District Court apparently viewed these as equivalents. (PX-J-39 pp. 13,272-13,273):

> "THE COURT: Well, now, *if* that is the *essence* of the invention—that's the avoidance of deep penetration—why isn't that mentioned in the claims?"
>
> [Counsel for plaintiffs]: I think that, as we pointed out a while ago, the things that are necessary are pointed out in the claims, because you speak there about avoiding material agitation of the bath by the oxygen stream; and as I said earlier, I think that that embraces——

[337] THE COURT: Well, then, that means the same thing.

> [Counsel for plaintiffs]: —this matter of avoiding deep penetration, yes.
>
> THE COURT: *Avoidance* of material agitation and avoidance of deep penetration are equivalents, you might say. One is the quid pro quo of the other; is that it?
>
> [Counsel for plaintiffs]: I hate to say that they are exactly equivalent,[47] your Honor . . .
>
> THE COURT: Well, I know; but my question was, you see, *if* the essence of the invention or *one* of the main thrusts of the invention is this avoidance of deep penetration, why isn't that set forth in the claim?
>
> [Counsel for plaintiffs]: Well, I think that it is set forth in the claim.
>
> THE COURT: Well, *it doesn't use that language.*
>
> [Counsel for plaintiffs]: No. That's right.
>
> THE COURT: Well, that's what I mean.

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[47] From what I had previously observed "deep penetration" with its bath "stirring" potentials was but one of the several prior art features included in the term "avoidance of material agitation." Others included could be off-central blowing, angular blowing, high blowing, etc.

[Counsel for plaintiffs]: There is no question but what that language was not used . . ." (Emphasis added)

[338] We have already seen several enlightening insights to the District Court's thinking. It had already accepted "avoidance of deep penetration" as being the "essence of the invention" predicated upon a conditional "if", and it was evidently reluctant to hear counsel's explanation that the term "avoiding material agitation . . . embraces . . . avoidance of deep penetration", without counsel's proffered explanation, "that means the same thing." Yet here again counsel for the plaintiff who should not have submitted so easily, answered affirmatively, but when the District Court assessed them as equivalent and "One is the quid pro quo of the other", counsel attempted once again to make what seems would have been a clarification. At least it might have been an answer and a clarification for the District Court.

Elsewhere I talked about other findings by the District Court on the problems which it posed of circulation in the center of the bath being both up and down at the same time, and of the impossibility of a 1 unit of force-power being able to overcome 3000-8000 units of force-power, and the fact that scientific answers were not available to the District Court.

I am fully convinced that these helped to solidify the District Court's thinking of "avoidance of deep penetration" as **[339]** the essence", "thrust" or "gist of the invention". Other circumstances such as Ann Arbor demonstrations, particularly Nos. 7 and 9, led the District Court to conclude that deep penetration of the oxygen jet in the bath was not injurious and that, therefore, Dr. Elliott was not credible. I believe they guided the District Court into the conviction that the total difference between the Suess patent and the prior art was the "lessening of impact pressure" of the oxygen jet upon the molten metal

bath, and that this avoided the deep penetration of which the prior art was guilty. There are other circumstances which I have discussed elsewhere and I do not deem it necessary to repeat them at this time.

Thus, there is built into the Opinion the conclusion that by reason of the circumstance that "avoidance of deep penetration" is the essence and subject matter of the invention, it should have been so expressed in the same precise words in the claim. That the District Court was looking for the same language is obvious when it stated (PX-J-39 pp. 13,272-13,273):

> "Well, it doesn't use that language . . .
>
> [Counsel for plaintiffs]: There is no question but what that language was not used, but I think that the——
>
> THE COURT: Was that ever used in any of the claims that Suess offered?

[340] [Counsel for defendant]: Yes, it was.

> THE COURT: I thought it was.
>
> [Counsel for plaintiffs]: I think so, your Honor, yes.
>
> THE COURT: And those were rejected.
>
> [Counsel for plaintiffs]: Well, yes; and the claims were rewritten in order to try to define the invention in such a way that would be acceptable to the Patent Office and which would still cover the invention.
>
> THE COURT: How was that presented to the Patent Office, then, in order to get the final claims allowed? *If* they *rejected it for the avoidance of deep penetration*, then, of course, it was kept out of the final claims." (Emphasis added)

Once more we see what seemed to be a fixed assumption by which the District Court furthered its judgment by using these words, but counsel for the plaintiffs did attempt to rectify that assumption in what follows (PX-J-39 p. 13,273):

> [Counsel for plaintiffs]: They didn't reject it on the ground that the claims called for deep penetration, no, your Honor. The claims were rejected for various reasons, and they were rewritten in order to try to satisfy the Patent Office."

Still we see that the District Court discredited counsel's remarks and adhered to its conception by which it had been questioning counsel during the final argument. Here is plaintiffs' counsel's reply (PX-J-39 pp. 13,273-13,274):

[341] "THE COURT: Why didn't they put that back in, then?

> [Counsel for plaintiffs]: Well, I think that probably the reason they didn't put it back in was that they felt that it was sufficient to set forth this guideline here which is phrased in terms of avoiding agitation of the bath by the oxygen stream. I think those are the words that were put into the claim for the purpose of trying to differentiate over this prior are such as Schwarz and Miles; and in addition to that, these other limitations were put in at the same time—namely, the localized reaction zone and the circulation caused by chemical reactions."

The Court eventually held " . . . that the specification gives the phrase 'avoidance of deep penetration' a special meaning by association with 'necessary and required process conditions, such as fluid slag, avoidance of over-oxidation (undue loss of iron to the slag), and avoidance of slopping.' (col. 3, lines 70-73)." (257 F.Supp. at page 422).

The District Court also eventually defined the significance of "avoiding deep penetration" to steelmen in these words, "Thus according to the teaching of the specification, a steelmaker knows he is avoiding deep penetration within the meaning of the patent if he does not blow deeply enough to cause refractory damage or to prevent the formation of a fluid slag, as Dr. Elliott and Dr. Hauttmann testified." (257 F.Supp. at [342] page 422). There-

upon it affirmed its belief in the invention and that it was capable of being accomplished by persons skilled in the art of steelmaking so as to enable them to make good steel.

> "In sum, this Court finds that the specification of the patent in suit, despite certain indefiniteness and inaccuracies, nevertheless complies with Section 112 by disclosing the invention in sufficiently clear terms to enable steelmakers 'to make and use the same.' At lease defendant has not sustained its burden of proving otherwise, especially in light of defendant's own testimony that persons skilled in the art could make satisfactory steel following the teachings of the example and that extrapolation to other heat sizes was a simple matter."

I originally started out in this part of the Opinion to discuss the statement by the District Court that the "Plaintiffs also admitted on final arguments that the only mechanical changes in method from the teachings and disclosures of Dr. Durrer and Dr. Hellbruegge were the changes from a Laval to a normal nozzle and an increase in the nozzle bath distance (R. 13,184-13,187)". (257 F. Supp. at page 410) While it would appear that I have strayed from an injury into this pertinent statement, further examination of the record as to why the District Court made this statement and whether or not it was based upon any misconception or misinterpretation of the **[343]** technical phases involved in the case—without fault of the plaintiffs, was necessary.

One may also consider the following (PX-J-39 pp. 13,328-13,329):

> "THE COURT: Even the term 'deep penetration' is not associated in language with the term 'material agitation' as such. I mean you don't find the words 'agitation' and 'material agitation' . . .
>
> But here you have a phrase which, as I understand it, is almost the gist of the patent, or, at least, one of the very important elements, the avoidance of ma-

terial agitation. And certainly you would agree, I think, that that must be taught.

[Counsel for plaintiffs]: Yes. I think it is taught, your Honor. That is what I am suggesting to your Honor now.

I think that, as I was saying in the first place, the patent tells you blow vertically or approximately vertically on the central portion of the surface of the bath.

THE COURT: But it doesn't go on to say that if you do that you avoid material agitation.

[Counsel for plaintiffs]: . . . But that is the way of blowing, as the evidence shows, which gives you the lease amount of agitation from the oxygen stream itself."

The District Court demanded further proof that the factors which contribute to the avoidance of material agitation were [344] actually stated in the specification "in that language" and "in so many words" (PX-J-39 pp. 13,329-13,330):

[Counsel for Plaintiffs]: Yes, And, of course, where you avoid deep penetration you avoid this material agitation of the bath by the oxygen stream.

THE COURT: Yes, that is what you say. That is true. But the specification doesn't use that language.

[Counsel for Plaintiffs]: That is correct.

THE COURT: It doesn't say that if you avoid deep penetration that material agitation would be avoided. *It doesn't say that in so many words.*

[Counsel for Plaintiffs]: That is correct, your Honor. But I think you must remember also that the prior art teaching is to agitate the bath by deeply penetrating into the bath. So that I think that the teaching of the specification to avoid deep penetration would be a teaching to those skilled in the art that you should avoid material agitation of the bath by the oxygen stream.

THE COURT: Would deep penetration necessarily cause material agitation, excessive agitation? Does that necessarily follow?

[Counsel for Plaintiffs]: I believe so. I think that that is the effect of it." (Emphasis added)

As may be seen, I have intently scrutinized the argument of plaintiffs' counsel purposely to ascertain whether or not [345] the plaintiffs were prevented in any way from presenting an understandable and graphic explanation of the Suess patent process. I continuously kept in mind whether the specification clearly defined and instructed on the technical aspects so that those skilled in the art could perform them, and whether the subject matter was detailedly and pointedly set out as claimed in the invention. I also look for what might have been explained in the final argument as the differentiation between the prior art and the new invention.

The plaintiffs here argue that there had been a fundamental misconception by the prior courts of the technical subject matter and issues involved resulting in a misintepretation and misapplication of the patent law to such technical facts. Accordingly, I expended extraordinary efforts in an examination of the Opinions, and of the record upon which they were founded, as mandated by *Blonder-Tongue*, in order to conscientiously arrive at both an understanding of the subject matter of the question of estoppel so that I might fairly and equitably determine the issues raised. Therefore, the general scope of my inquiry was directed at the District Court's statements relating to Dr. Trenkler and Dr. Hauttmann, and of plaintiffs' admission [346] on final argument "that the only mechanical changes in method from the teachings and disclosures of Dr. Durrer and Dr. Hellbruegge was the change from a Laval to a normal nozzle and an increase in the nozzle bath distance" from 10 centimeters to 15 centimeters. (257 F.Supp. at page 410)

Dr. Trenkler and Dr. Hauttmann did say that in their early experimentation in June 1949 there were changes in type of nozzle and of nozzle-bath distance. They also stated that these were changes from the prior art of Schwarz and Miles, and that these two changes did not become features in the application by Suess for patent rights. We are informed that there were approximately 250 tests required for ascertaining the circumstances necessary for such a final working process, and that although the experimenters produced good steel with the June 25th series of tests, there is no evidence in the record that steel of open-hearth quality was achieved.

My inquiry shows that counsel for the plaintiffs did feature avoidance of deep penetration as the "new concept" and as differing from Schwarz and Miles, as well as from Durrer and Hellbruegge. It also shows that plaintiffs' counsel while featuring the avoidance of deep penetration put on a "selling [347] campaign" to the District Court of "reduced impact pressure of the jet on the bath so as to avoid deep penetration" and that he in very great likelihood oversold this feature at the trial. However, the inquiry shows that the plaintiffs' counsel did not advocate "avoidance of deep penetration" or "reduced impact pressure" as the exclusive feature of the Suess process, although he advocated the others less convincingly. My inquiry shows that he did attempt to advocate "deep penetration" and "heavy impact pressure of the oxygen jet" as prior art devices required for stirring the bath. However, it may not be said that plaintiffs' counsel did not attempt to advocate vertical blowing as against the angular blowing of the prior art; central surface blowing as against the non-specified blowing of the prior art; ratio of bath depth to surface area requirements; prescribed limits within which pressure was to be applied, and of prescribed height distances within the limits as set forth in the specification, all for the purpose of procuring a "localized reaction zone" at the center surface of the bath

to bring about chemical circulation as against mechanical jet circulation. All these and more were the instructions contained in the specification. None of these [348] found meaning, since no finding supported their existence in the Opinion.

So it is that while the Opinion credits Dr. Trenkler, Dr. Hauttmann, and plaintiffs' admissions on final arguments, to the effect that there were only two changes, such findings have absolutely no connection with or effect upon the patent's specification. The District Court Opinion attempts to make that connection by finding that the original change of a nozzle and of nozzle bath distance were the changes which provided "a reduced impact pressure of the jet on the bath so as to avoid deep penetration"; that "Such avoidance of deep penetration" was " 'the new concept, the new mental approach' of the patentees" (257 F.Supp. at page 410), and that "Such maximum limit on penetration appears to this Court to be the real gist of the invention by the patentees . . ." (257 F.Supp. at pages 403, 411-412)

The District Court Opinion indicates that this idea of "impact pressure" originated as of the time the testimony was adduced on the experimentations made on June 17th and June 25th, 1949. Thus it would seem that the admissions of Dr. Trenkler and Dr. Hauttmann, as well as of the plaintiffs, including the [349] advocacy of plaintiffs' counsel, were not in reality the moving cause for the District Court Opinion's finding that the new invention existed only because of the lowering of the impact pressure.

[350] **XVII. Oxygen Availability**

It is also incumbent upon me to inquire into the matter of oxygen availability to the prior art patentees, Schwarz and Miles. This is so for two reasons: first, because the plaintiffs in these cases contend inter alia, that the *McLouth* Courts failed to grasp the technical aspects of the case and the real issues involved, and thus were deprived

of the benefit of crucial evidence and witnesses in the first litigation; and second, because *Blonder-Tongue* also directs that, "if the issue is non-obviousness, appropriate inquiries would be whether the first validity determination purported to employ the standards announced in *Graham* v. *John Deere Co., supra.*" (402 U.S. at page 333).

The Schwarz German patent was "as from May 24, 1939," but "allowance of the patent [was] made known on April 8, 1943." It was "published on July 3, 1943." (DX-5A) The Second World War ended on September 2, 1945. The Miles patent application was filed in the Kingdom of Belgium on October 4, 1946, and the patent was granted on November 30, 1946. Oxygen availability for industrial applications should be related accordingly.

The *McLouth* Court of Appeals recognized that oxygen availability affected the non-obvious issue. It said this:

> "Prior to 1950 not a great deal had been done commercially with the use of pure oxygen in the refining process. McLouth contends that this lapse in the steelmaking industry was due to the *unavailability of a method* for producing oxygen cheaply in commercial quantities. Appellants contend that the lapse was due to the *lack of an operable method* for refining steel with pure oxygen. In view of the *conflicting* [351] *evidence*, the District Court found that it was unable to ascertain a date when the use of pure oxygen in commercial quantities became economically feasible but held that the unavailability of oxygen in commercial quantities would not necessarily have inhibited experimentation. (257 F.Supp. at page 398). We agree with this finding of the District Court but must also note that the lack of commercial quantities of oxygen would affect the quality of the disclosures in the prior art on matters such as specific commercial operating conditions, demonstrative examples, and the like. Moreover, the commercial unavailability of oxygen would explain the absence of any prior attempts to apply the Schwarz and Miles Patents and would thus weaken any inferences that such a lapse in the industry might raise on the issue of obviousness. Thus, the im-

> portance *of more direct evidence* on the issue of obviousness becomes even more apparent." (Emphasis added). (400 F. 2d at page 42).

Specifically on this point the District Court said:

> "It is *disputed* at what point in time pure oxygen became available in large quantities for use in commercial production of steel. *Defendant contends* that oxygen did not become available inexpensively in large quantities until the late 1940's, so as to inhibit the development of a commercial oxygen steelmaking process before that time. *Conflicting evidence* on the point leaves this Court *unable to fix* with certainty any date on which oxygen became available inexpensively in large quantities for commercial production of steel." (Emphasis added). (257 F. Supp. at page 398).

I note in advance that in the District Court there was "conflicting evidence on the point" which left the District Court "unable to fix" the oxygen availability date. But from an examination of the record, "conflicting evidence" was presented in many other phases of the trial, and yet the trial judge assumed the function as a fact finder to make determinations and fix the facts from conflicting evidence as they were presented, as occurs in practically every case. This then was a failure on the part of the District Court to **[352]** present a relevant fact which could aid in the question of determining nonobviousness and left that matter to the Court of Appeals.

The Court of Appeals, however, accepted this failure by the District Court to arrive at a decision on the date of oxygen availablity on the more positive side for the benefit of the defendant as "lack of commercial quantities of oxygen . . . [as] would affect the quality of the disclosures in the prior art on matters such as specific commercial operating conditions, demonstrative examples, and the like." (400 F. 2d at page 42). From this then the Court of Appeals provided what seems to be a positive

finding of fact that "the commercial unavailability of oxygen would explain the absence of any prior attempts to apply the Schwarz and Miles Patents . . ." (400 F. 2d at page 42). Therefore, I deem this failure on the part of the District Court to arrive at a determination on the date of oxygen availability as highly pertinent in lending a factual circumstance to support at least the one phase of obviousness, or non-obviousness, of the Suess et al. patent. Accordingly, I have inquired into the record on this phase of the matter.

I have already reported on a part of this specific matter in my discussion of the Durrer and Hellbruegge experimentations at Gerlafingen, Switzerland (See No. XV, Prior Art Changes). I discussed the fact that both Durrer and Hellbruegge had been working on oxygen smelting on an industrial scale (PX-J-14 p. 4514), before January, 1941. I discussed the testimony of Dr. Hellbruegge and particularly stated the fact that in the late 1930's adequate quantities of oxygen were available for experimental work. He stated that in developing "a new metallurgy" commercial quantities of oxygen were not **[353]** required, but merely an adequate quantity to carry on experimentation. Thus, this would prove what the District Court said that:

> "However, in light of the limited experimentation with oxygen in steelmaking as early as the 1930's, the alleged unavailability of oxygen for commercial production before the late 1940's would not necessarily have been an inhibiting factor on experimentation with oxygen in steelmaking." (257 F. Supp. at page 398).

What is more important is that Dr. Hellbruegge testified that large quantities of oxygen were available about 10 years before his "Stahl and Eisen article of December 21, 1950" (PX-J-15 pp. 4902-4904). I note here particularly that Dr. Hellbruegge, as well as Dr. Durrer were defendant witnesses at *McLouth*. I do not forget that the McLouth

record reveals the fact that in 1928 Dr. Fraenkl discovered the process of extracting oxygen from the air on tonnage quantity basis, and that this discovery was assigned to the Linde Company. The discovery was known as the Linde-Fraenkl process. When Dr. Durrer was asked in cross-examination, during the trial of the case (PX-J-16 p. 5068), relating to the Linde-Fraenkl process,

> "Q. (By Mr. William Webb) And by making it cheaper, did that make it available for use in the metallurgical processes, Doctor?
>
> A. Yes."

Although oxygen was used from portable bottles during the 1930's, Edward John Prince, plaintiff's witness, testified that (PX-J-17, p. 5333) at Appleby-Frodingham they piped the oxygen which was brought in by cars from a central plant in 1936 or 1937. He also said that in 1947, the Dominion Company in Canada had an "on-site plant" from which "the oxygen was piped to the various **[354]** departments."

But the testimony of Dr. Durrer and Dr. Hellburegge on this subject of oxygen availability did not stand alone. There was other defense testimony in this regard. For instance, there was the testimony of Lyle J. Johnson, Vice-President of Engineering of McLouth, as follows (PX-J-11, p. 3443):

> "Q. And as of 1940, there were a number of tonnage oxygen plants that had been constructed?
>
> A. Yes. I do not know the exact number.
>
> Q. That would have been suitable for this type of usage?
>
> A. Yes."

We bear in mind also that it was the defendant's contention which was adopted by the Court, that "oxygen did

not become available inexpensively in large quantities until the late 1940's, so as to inhibit the development of a commercial oxygen steelmaking process before that time." (257 F. Supp. at page 398). Since it was the defendant's burden to prove that contention, its failure to prove it, did not make it the fact which it alleged. Moreover, since such evidence related to both §§101 and 103 of the patent statute, as well as to the relationship of non-obviousness, the burden was upon the defendant to prove such unavailability of oxygen by evidence which was at least clear and convincing. *Trio Process Corporation* v. *L. Goldstein's Sons, Inc.*, 461 F. 2d 66, 70, C.A. 3, 1972.

In any event, not only did the defendant fail to prove such a contention, but its witnesses in effect contradicted that contention, and the District Court could have so found —as it did with the other unproved contentions (257 F. Supp. at pages 395, 406, 418, 424), thus furnishing no basis for the **[355]** Court of Appeals to hold that ". . . the commercial unavailability of oxygen would explain in the absence of any prior attempts to apply the Schwarz and Miles Patents . . ." (400 F. 2d at page 42).

So far as I can see in the record, any bare "conflicting evidence" arose between the defendant's own witnesses and not from anything which the defendant's witnesses contradicted in the plaintiffs' testimony. Under these circumstances there can be no basis for a finding of fact that availability of oxygen for industrial purposes did not exist after the Schwarz patent was issued.

Although it was not mentioned in either *McLouth* Opinions, it is a fact that the Second World War disrupted the orderly inventive process. Nevertheless, it would appear that if the Schwarz patent, for which application was made in 1939, had any value at all, it would have been utilized by the German authorities. That this was not done may suggest and support a conclusion that it was incapable of being industrially utilized because of a lack of sufficient

quantities of oxygen, or because it was unworkable or could not produce according to the needs of the German war efforts. It may also be speculated that the Miles patent was not utilized because of the decreased steel demand after the war, or because it was not productive of the results which it claimed, or because there was no available oxygen for its industrial utilization during the period from 1946 to 1949. While this is purely speculation, one may reason that during the war years intense concentration would have focused on augmenting steel production.

By analogy one may consider the development and research on "U-235", **[356]** which contained the anticipated miracle energy which would outdistance anything yet known to man. To develop this some of the greatest scientific minds, and energy were secured from all parts of the world in order to produce the first atomic bomb.[48] In a similar manner, many scientists in Europe knew about the concept of processing iron into steel by the use of oxygen applied to the surface of the bath, and had been experimenting with it for a number of years. If Schwarz's theory was as utilizable as he contended in his patent as early as 1939, and even earlier in his experimentation, and in view of the knowledge that a method for obtaining pure oxygen had already been presented as early as 1928, then one would have anticipated more rapid development in iron refining.

It is apparent from the record that even prior to Schwarz's patent, there were a number of plants already in production of pure oxygen, and that these plants were dispensing it in bottles and transporting it to the users. The record indicated that oxygen-producing plants could be constructed at the site where it was to be used—and that was what the Suess patentees did, thus avoiding the necessity and expenses of bottling and transporting. The

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[48] This will be remembered as the "Manhattan Project."

question arises, if the Schwarz patent was as good as it claimed, why would not the H. A. Brassert & Co. of Berlin-Charlottenburg, by which Schwarz was employed, have erected the necessary oxygen plant at the place of manufacture of steel, while, as we shall soon see, others in Europe constructed such plants. That this was not done raises the presumption that the Schwarz patent was not within [357] the competence it claimed; additionally, as was afterwards shown by Durrer and Hellbruegge at Gerlafingen, the Schwarz patent produced steel of an inferior quality, and in the course of its operations, the refractory linings of the vessel were quickly destroyed.

Although I have presented here what appears to be conjecture, it is in reality not so much conjecture as information ascertaned from published reports. I have considered the positive evidence submitted by the defendant McLouth of the availability of oxygen sufficient for steel manufacture. I conclude that this state of the evidence in *McLouth* should not have supported any attack on the element of non-obviousness of the Suess process. Furthermore, for the purpose of resolving any doubts in this connection, I have examined the relevant published periodicals presented to me by counsel. These clarify the scientific progress relating to the development of oxygen use and its availability, as well as economic costs. From all of these it appears that in the early days after 1928, the first use of the oxygen tonnage process was for procuring nitrogen from the air to be used as fertilizer, while the purified oxygen found practically no use at all. That is not to say that there was no experimentation going on both in Europe and in the United States. I do not concern myself here with ordinary air as it was used in pneumatic blowing, but only with oxygen and oxygen-enriched air as efforts were made to find greater productivity with its use.

Published Reports

From the AISI (American Iron and Steel Institute) Yearbook 1920, we learn **[358]** in an article entitled "The Future of Oxygen Enrichment of Air in Metallurgical Operations" by F. G. Cottrell, Director of the Bureau of Mines, Washington, D. C., that the Government had built an installation for air separation at Mussel Shoals, Alabama during the First World War. This consisted of thirty of the largest sizes of Claude units. Both Carl Linde of Munich and Georges Claude of Paris had innovated the commercial development by which air separation into nitrogen and oxygen was made through liquefaction and distillation (see page 109). However, we learn that the cost of oxygen at that time was from $25 to $30 per ton. The knowledge of its use was very narrow, restricted primarily to the fields of cutting and welding, and for these purposes bottle oxygen was sufficient.

Another paper presented in the same periodical was from Fred E. Norton, Vice-President, Jefferies-Norton Corporation, Worcester, Massachusetts, who said (at page 127): "The cost of oxygen depends directly on the use to be made of it. If there is no use for the oxygen, the matter of cost is without interest." This was said after "some seven years' investigation of the causes of the high and prohibitive cost by the existing methods of air separation" by which oxygen was produced. He did assert that the cost could be reduced to about one-twelfth by reason of the 'present processes". (at pages 127-128). He then followed this up with this statement: "The possibility for cheap industrial oxygen exists. It is up to the metallurgical industry to create a demand and put the oxygen to work." (at page 134). This was corroborated by another statement in the same publication by E. A. W. Jefferies, Manager, **[359]** Gas Producer Department, Morgan Construction Co., Worcester, Massachusetts, who said: " . . . the availability of oxygen at the extremely low cost which is

now in sight gives another large promise of economy in steel making." (at page 140). His viewpoint was directed to the use of oxygen in the blast furnace.

A report entitled "The use of Oxygen or Oxygenated Air in Metallurgical and Allied Processes" was published by the Department of the Interior, Bureau of Mines in July, 1923. The report of a previously appointed committee was made by F. W. Davis, a metallurgist in the Bureau of Mines Station, University of Minnesota. The study revealed that:

> " . . . the comparatively small demand for the product [oxygen] has prevented the installation of large units suitable for metallurgical processes . . ."

The report stated:

> "This committee has made a thorough survey of the existing processes for the manufacture of 99 percent oxygen. The conclusions reached by this survey are that the comparatively small demand for the product has prevented the installation of large units suitable for metallurgical processes, with corresponding economies, and by far the greater proportion of the present cost of oxygen represents the cost of transportation, storage and service. Large oxygen manufacturing plants can be built to serve metallurgical purposes directly, which, by virtue of their large production and correspondingly increased efficiency, together with the fact that no compression in cylinders, storage, transportation, or service will be required, will be capable of delivering oxygen for the processes at a cost not to exceed $3 per gross ton. In other words, the Committee finds that the oxygen industry is now able to make plants for supplying large quantities of oxygen to metallurgical industries at low cost." (at page 4).

The thinking of the use of oxygen still lay in its[360] application in the operating of the blast furnace, open-hearth furnace and Bessemer furnace.

During these years, and as they continue into later years, more than thirty steelmen and more unnamed steelmen were active generally in the field of oxygen refinement (PX-308) (PX-J-16 p. 5112). The list apparently included John Miles of John Miles & Partners (London) Limited, the steelmaking company in Great Britain, as well as C. B. Schwarz of H. A. Brassert & Company.

One year later in June, 1924 David reported in a paper to the Association of Iron and Steel Electrical Engineers in a report published by permission of the Director, United States Bureau of Mines. The title of the paper was "Some Applications of Oxygen to Ferrous Metallurgy." In this paper he recited that large oxygen manufacturing plants could be built to serve metallurgical purposes directly, and that "in other words, the committee finds that the oxygen industry is now able to make plants for supplying large quantities of oxygen to metallurgical industries at low cost." (at page 340). Davis regretted that the then available refractories were incapable of being subjected to thermal conditions created by the use of oxygen and recommended the necessity to change materially furnace design and practice.

In a translation from a publication in 1925 in Stahl & Eisen, Volume 45, pages 1873-1878, written by J. Haag Oberhausen, there was the report that the Americans were working intently on the solution of the problem of producing oxygen in large quantities and at so low a cost that the use of oxygen enriched air by the steel industry would be economical. He also reported that in Germany certain plants were conducting experiments on a larger scale, and particularly **[361]** at a Bessemer plant "in refining and in converters".

Up to this time Russia was interested in the blowing of oxygen enriched air and pure oxygen into the Bessemer as revealed in the publication Kislorod (Russian) in 1945 by M. S. Shapovalov, vol. 2, No. 1, pages 25-30. In it the

author presented many details of the problems involved and the need for finding solutions. Among the problems were the poor quality of metal obtained as well as the effect upon the wearing out of parts of the vessel "in view of strong localized overheating of the bath". Of interest is his statement (at page 7):

> "The idea of using an oxygen blast in the converter processes is quite old. The problem was studied first in a paper by F. Wust and L. Laval. Later on (in 1923) a paper by F. Davis on the same subject appeared in which the beneficial influence of oxygen-enriched blast on the metal bath in the converter was pointed out." (Footnotes omitted).

In the Iron and Steel Engineers Yearbook in 1948, a report entitled "Oxygen Uses in Steel Production" by J. H. Zimmerman, Manager, Development Division, Linde Air Products Co., summarized much of the development and research work accomplished in the use of oxygen in the open-hearth. It indicated that over 6,000 heats using oxygen in some 34 furnace shops, the majority of which had availed high purity 99.5% oxygen "supplied from existing liquid oxygen systems because of its availability in substantially large volumes and ability to serve high demand rates."

After the delivery of the paper by Zimmerman, a discussion period was held by three steelmen. One of these was A. G. Robiette, Director, John Miles and Partners, London, England. He told them what was being done in England in [362] regard to the use of oxygen, and said that they started with actual pilot scale experiments in about 1945. He said that they rejected the idea of using oxygen as an adjunct to the open hearth furnace and thought "you could convert your pig iron into steel without the use of any fuel whatsoever and our experiments have been directed on those lines." This was done in an electric furnace with 90% oxygen. He reported that the product contained about half the oxygen found in open

hearth practice, and that heats of steel had been produced from straight carbon iron made synthetically just to prove that this could be done. He stated finally that "We have developed a method of blowing, which does not employ any lances whatsoever. It is blowing with jets spaced from the surface, and there are two production size plants going up in Sweden for using this process, as well as one in France and one in England." Robiette did not report on the unwanted element contents remaining in the iron nor upon the condition of the refractories in their "actual pilot scale experiments".

Since I report upon a paper published by Robiette one year later, I reserve my comments in this connection for later discussion.

Also, in the same year, 1948, in a paper on the "Utilization of Oxygen in Smelting Low-Grade Ores", Dr. W. M. Pollitzer, Technical Industrial Intelligence Division, Department of Commerce, Washington, told of "the Gute Hoffnung Huette plant", Omerhausen, Rheinland, as being "the first big steel combine in Germany, and, as far as it is known, in the world, to build a blast furnace for experiments with oxygen-enriched air." It was reported that this was accomplished in 1933. The experiment used more than 26% enriched oxygen air and was found to be unsuccessful.

[363] This same report discussed the use of oxygen in the German iron and steel industry at Suddeutsche Kalkstickstoff Werke, Trostberg, in Eastern Bavaria, where it was decided to utilize "cheap oxygen" because the Linde plant was manufacturing nitrogen as fertilizer, leaving the oxygen by-product for which there was little use. The responsible German Government Board decided to avail itself of this cheap oxygen by building a low shaft blast furnace and using a high concentration of oxygen.[49]

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[49] I report elsewhere that in and around 1944 Dr. Hellbruegge went to Trostberg to work with Dr. Durrer on a large low shaft

In 1948 Dr. W. M. Pollitzer reported in a paper entitled "Utilization of Oxygen in Smelting Low Grade Ores" that

> "The most interesting example of oxygen-enriched blast in German iron and steel industry is at the Suddeutsche Kalkstickstoff Werke, Trostberg, in Eastern Bavaria far from all raw materials necessary for iron and steel production. The plant was built because of cheap power. A strange situation existed insofar as the manufacture of fertilizers produced oxygen as a by-product (nitrogen being the main product) from the Linde plant . . . In order to utilize this cheap oxygen the German Government Board responsible . . . decided that a low shaft blast furnace using high concentrations of oxygen should be built at Trostberg . . ."

Also in 1948, Julius Strassburger, Manager, Department of Service and Maintenance, Weirton Steel Company, presented a paper before the AISI entitled **[364]** "Tonnage Oxygen—Versatile Aid . . . for increasing iron and steel output", in which he discussed the use of oxygen for enriching the blast for the blast furnace and to accelerate combustion and decarbonization in open-hearth furnaces and for enriching the blast in the Bessemer converters, where dictated by economic and local plant conditions. He reported that during World War II, the United States, in conjunction with the National Defense Research Council, "together with the technical talent of this country" produced portable and stationary oxygen plants for use in the Pacific, on shipboard, and at other battle fronts. He stated that as a result of this development, necessary

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oxygen furnace. This most likely is the same low shaft furnace which was built by reason of the utilization of the low cost oxygen from the nitrogen fertilizer plant. (PX-J-14 p. 4521). Dr. Durrer spoke of the test at Gute Hoffnung Huette, Oberhausen, Rheinland, run in 1931 (PX-J-16 pp. 5067-5069) which were smelting tests suing oxygen enriched air in a low shaft furnace. He met with Dr. Karwat and Mr. Fraenkl as early as 1929 with relation to this work.

knowledge was obtained to build large plants without chemicals for the production of tonnage oxygen and "a new tool was made available for expanding the production of iron and steel". He discussed the cost and arrived at the figure of $3 per ton of oxygen.

Later in 1956, Julius Strassburger, then Assistant Vice President, National Steel Corporation, Pittsburgh, Pennsylvania, presented a paper entitled "Blast Furnace Oxygen Operations" before the general meeting of the AISI in New York in which he said:

> "In 1946, approximately ten years ago, the Weirton Steel Company installed several small pure oxygen plants for the production of 99.5 per cent oxygen for general steel plant use, such as scarfing, welding and scrap cutting . . ."

From the paper I conclude that the oxygen was not being used as an agent for conversion of pig iron into finished steel, as was done by Schwarz, Miles, Durrer and Hellbruegge, and eventually by the Suess patentees.

Of relevant interest is a statement in this report that:

[365] Considerable theoretical studies were made by the United States Bureau of Mines during the decade of 1920 to 1930 on the use of oxygen in blast furnace operations. The next historic step in the development of the oxygenation of blast furnace air was a result of the development of the Linde-Frankl tonnage method of producing oxygen in Germany. This process paved the way for obtaining tonnage oxygen at relatively low costs, and this factor encouraged Lennings in his large scale pilot work which he conducted at Oberhausen, Germany between 1933 and 1940." (at page 1).

Further information on the years in question is contained in an article entitled "The Influence of Oxygen on World Steelmaking". This article was printed in the December, 1959 issue of Iron & Steel. Dr. D. W. N. Pitts,

M.Sc. and J. L. Harrison, F.I.M. stated that "One of the first open-hearth flame enrichment trials of which we have detailed technical (sic) records was carried out in 1923 by the United States Steel Corporation at their Homestead works." (at page 567). In the next ten years, the report states, as far as the supply of oxygen was concerned, evaporated liquid oxygen became available while, in 1930, the Linde-Frankl distillation cycle was introduced which then made possible the provision of tonnage oxygen. Since that time plants have been designed and installed in Britain and other countries with improved overall efficiency and lower tonnage oxygen costs. They also tell of the economic and political upheavals in intervening years. In their words:

> "In view of the fact that relatively cheap oxygen was available as early as 1930 either as evaporated liquid or from tonnage plants it might appear surprising that the encouraging results of the early metallurgical trials were not more rapidly followed up. In fact, these delays were largely due to the economic and political upheavals of the years before 1945. Prior to the war there was only a limited demand for steel and the economic atmosphere was not conducive **[366]** to experiments whose function was to increase productivity on a plant that was already working under capacity."

Since that time, and I assume that the year 1945 is referred to, the international demand for steel had been expanding and with it the use of oxygen and metallurgy had grown. The developing steel market stimulated the introduction of techniques which in the first instance were designed to increase production. If so, I question why the Schwarz process had not been as immediately successful as was eventually the Suess process. All the publications are devoid of any mention of the Schwarz process. In fact, an article by Schwarz in 1949 practically ignored his own process.

In 1949, a paper entitled "The Present State of Development of Oxygen Refining in the Siemens-Martin and Electric Furnaces" (translation from German), was published in "Radex Rundschau" by von C. V. Schwarz. This was approximately 10 years after Dr. Schwarz had filed for a German patent and 6 years after it was published. In this discussion on oxygen blowing in Siemans-Martin and electric furnaces, he said (pages 2-3):

> "These (sic) were no large-scale experiments in Europe during the war. In comparison, after the war until the beginning of 1948, several thousand oxygen heats had already been melted in the United States, showing very good results with pig iron ore melts and extra soft scrap-pig iron melts, and bringing the procss to a definite operational stage."

It is apparent from the translation as well as from the sketches contained in the original German paper, that Schwarz was talking about several thousand oxygen heats as experiments "melted in the United States" as they related to the open-hearth and electric furnaces. However, he also discussed the [367] application of oxygen to blast furnaces. It is of particular interest that he did not discuss the Schwarz patent method as it might have been experimented upon or utilized in the metallurgical industry during the years under discussion.

This report stated that the Weirton Steel Company, realizing the advantages of the process, had "provided for an oxygen installation with a capacity of approximately 110,000 tons per year of 10,500 standard cubic meters per hour to increase their steel production about 500,000 tons per year . . . The total price of the installation is indicated at $4,000." After discussing the make-up of costs and amortization, he said that "Recently manufacturing costs of $8.82 per ton including amortization were announced." I am curious as to why in 1949 Dr. Schwarz would make such statements when and if his

patent of 1939-1943 was productive of industrial steel as he claimed, and particularly during the time of intense experimentation both in Europe and in the United States on the expanding use of oxygen.

Also in 1952, Dr. Schwarz gave a report of the steel plant committee of the Association Iron and Steel in Genoa. It was entitled "Blowing of Basic Bessemer Pig Iron With a Free Jet Lance" (DX-183E). Actually this report is a repetition of his discussion (DX-182A). At page 3, Schwarz stated that the Laval nozzle was used in Switzerland and the United Kingdom during the war without success. If then this use was in commercial operations, it can be assumed that 0_2 was available in commercial quantities.

From all that was reported by Schwarz in these two papers it is obvious **[368]** that he never claimed that "good steel" was produced by these tests. Although his discussion and "Table 1" evidenced the fact that nitrogen absorption was diminished, there is no mention of ductility, malleability or other relevant criteria qualities in steel required in its industrialization. Table 1 provides a partial analysis of the finished product, but it only measured the levels of carbon, manganese, phosphorus and nitrogen. Remembering that German industry in the 1930's and early 1940's was linked directly to the government, it can be assumed that the industrial use of oxygen would not have been as strictly geared to profit as it would have been in private industry. Thus, a private corporation might have hesitated in making immediate use of oxygen resources, whereas the stress upon a government at war to use existing facilities to their utmost would be no inhibiting factor in the production of badly needed steel, if the process was what Dr. Schwarz claimed it was in his patent.

Just as I scrutinized the report of Schwarz in 1949, I also examined closely a second report by A. G. Robiette,

M.Sc., F.I.M., published in the Iron and Coal Trades Review of May 28, 1948, speaking of the use of oxygen for steelmaking—"Methods of Application and Operating Results". A. G. Robiette, a Director of John Miles & Partners (London), read a paper before the Norwegian Metallurgical Society on April 26, 1948 in Oslo. It will be remembered that John Miles made applications in Great Britain on May 3, 1945, June 15, 1945, January 4 and 11, 1946 and was granted a patent.

In the paper delivered at Oslo, he reviewed various applications of oxygen. **[369]** This he said was made possible by the developments in the production of cheap oxygen by the Linde-Frankl and other systems. He said that these "have so reduced the cost of oxygen that it can now be seriously considered both for combustion systems and for the refining of pig iron and the production of steel." (at page 1103). In discussing the application of oxygen in its use as a refining agent in open-hearth or electric furnaces, Robiette suggested, as did Miles in his patent, that for carbon removal the oxygen was to be injected "into the bath" and that instead of one or two jets or lances "a large number, say, eight or ten small high-velocity jets should be used." (at page 1104). He said that this would spread the "disturbance effect" over the whole bath. Robiette concluded (at page 1106):

> "The use of oxygen for steelmaking, though still in its infancy, has brought about a new set of physical conditions which, if taken advantage of, can materially assist in improving both the quality of the product and the efficiency of the steelmaking operation. The problem must be approached with an open mind and it would be wrong to assume that oxygen is best applied to existing processes and existing equipment. All the many and various physical problems must be studied and all pre-conceived ideas of existing steelmaking plant and processes discarded. This is not meant to imply that oxygen may not in certain cases be used to assist an existing process especially as an

> interim measure, but if a fresh start were made, it has to be determined how this new tool, which has been put in the hands of the metallurgist, can be best applied."

Again, nothing was said about either the Miles or Schwarz patents, but rather attention is directed to securing a "fresh start" with a "new tool". These remarks by a director of John Miles & Partners (London) Limited are indeed strange, if in 1948 the John Miles patent was the "remedy" which John Miles **[370]** stated it to be in his application. It is also remarkable, if in fact the Schwarz patent process was workable and capable of producing high grade steel of a quality equal to that of open-hearth production. Additionally, in 1948 Robiette, who talked about direct oxygen conversion of pig iron (as claimed by Schwarz), did not even mention the Schwarz patent—and even more remarkable he did not mention the John Miles patent by name. This is unusual, if in fact these were already practical and accomplished processes for which they were all searching in their experimentations.

I make two observations from Robiette's remarks. First, that Miles steel works were experimenting with oxygen application to pig iron conversion into steel, and that no industrial applications were yet accomplished. However, I do not disregard the statements of Robiette in 1948, when in conversation with other steelmen, he had stated that " . . . there are two production size plants going up in Sweden for using this process, as well as one in France and one in England." If such plants actually were established in the 1940's it is highly unlikely that they would have been overlooked at the *McLouth* trial or at the trials before me, if in fact such production plants were successful with the Miles patent. I assume that the "production size plants" going up in Sweden and using this process related to the work conducted by Drs. Durrer and Hellbruegge at Gerlafingen. As for those in France and Eng-

land, nothing more seems to be reported, although a search of publications up to 1970 fails to reveal any information in this regard. Second, no complaints or objections were made by Robiette that oxygen was unavailable or unobtainable for such industrial applications. Furthermore, Schwarz made no such complaints in his [371] report a year later.

While the Schwarz and Robiette articles give us information on the "experimentation" which was going on with the application of oxygen in the making of steel and of its proportionate lack of utility in that field, the articles are more informative of the fact that neither the Schwarz patent nor the Miles patent had yet provided the "remedy" for converting pig iron into steel as was eventually accomplished in 1950 by the Suess patentees. In addition, the articles demonstrate that oxygen was in sufficient abundance for such industrial applications as would be commensurate with the needs of the prior art patent processes.

It is fairly obvious to me from the evidence submitted before the *McLouth* District Court and from these various historical published reports on the subject of oxygen use in the steel industry, that at all pertinent times oxygen existed and was available for manufacturing purposes, and that no steelmaker or "experimenter" was handicapped by reason of the unavailability of oxygen.

Whether or not this was made abundantly clear to the District Court in *McLouth* is a question which I must ponder in connection with all other matters of equity in this, my assignment, to ascertain whether or not the plaintiffs contributed such fault in the conduct of the *McLouth* case as to be equitably and justly denied the right to pursue these *J & L* cases on the basis of *Blonder-Tongue* estoppel.

[372] *Conclusion*

While Carl Linde and Georges Claude had prior to 1920 conceived the idea of extracting oxygen from the air, and

making it available in bottles for storage and transportation, it was not until 1928 that Fraenkl introduced the method of making tonnage oxygen available on a large scale. At that time in Germany, the Linde-Fraenkl plant was established and in other places, including the United States, a large number of plants produced oxygen and made oxygen available for scarfing and oxyacetylene uses. The early thought was in attempting to enrich the air which was introduced into blast and Bessemer furnaces for speeding up the steel process. However, too many disadvantages arose which made it impractical. After the Linde-Fraenkl process was divulged, the United States Government procured portable oxygen-making plants which it used during the Second World War. In West Virginia, the Weirton Steel Company had established a plant in 1946. In Germany, Dr. Carl Schwarz of H. A. Brassert & Co. was issued a patent on surface application of oxygen to molten metal but as late as 1949, it is obvious that Dr. Schwarz had not yet arrived at a practical method of industrial steelmaking. In 1943 and 1946, John Miles of the John Miles & Partners (London) Limited, a steelmaking company in Great Britain, also was issued a patent, but it is apparent from a director of that company, one Robiette, that the Miles process was still in its experimental stages. In any event, it is apparent that relatively cheap oxygen was available as early as 1930, either as evaporated liquid or from tonnage plants. It was also true that oxygen plants were being constructed and could be constructed at [373] the sites of steel mills for cheap tonnage oxygen. However, while nitrogen was being recovered for use as fertilizer by this method, no substantial use for the cheap oxygen by-product had been as yet discovered. While the later war years and post-war years found a lag in the steel market demand, experimentation continued on oxygen utilization in the steel industry. Both Schwarz and Miles, connected as they were with steel manufacturers, also continued experimentation, but neither

were instrumental in bringing about an oxygen steelmaking plant in accordance with their patented processes. Neither, in published papers, claimed anything more than experimentations; and neither claimed that he had insufficient available oxygen for making his process workable.

So that in the early 1940's, it was possible to build a plant for the industrial application of oxygen, yet no unusual occurrence had taken place up until 1951-1952 when the Linz plant was established for tonnage oxygen used directly in steel conversion.

From the viewpoint, then, that the cost of installing the oxygen mill with the use of a vessel capable of being inclined on a trunnion, and for the economical recovery of high quality steel from iron in a matter of 20-30 minutes as against eleven hours under the open-hearth method, the cost of the oxygen which prevailed during the 1940's would have proved no hindrance to anyone who wished to follow the Schwarz or Miles patents. In any event, the *McLouth* record is devoid of legal proof bearing upon prior art obviousness and utility in derogation of the Suess et al. patent.

[374] **XVIII. Court of Appeals**

I said earlier that there was some noticeable difference in the thinking in the opinions of the Court of Appeals and the District Court. However, before discussing these, I believe it is imperative that I point out that the Court of Appeals accepted a great deal of the conclusions made by the District Court; the most critical of these was that "avoidance of deep penetration was the [subject matter and] gist of the invention". This is reflected in its various comments throughout its opinion, and by its interpretations and thinking in this respect, and particularly as it related "avoidance of deep penetration" to the continuation-in-part application's first four claims and following claims, and as the District Court had found that the

chemical aspect of the Suess patent had been obvious to prior art. However, at no place in its opinion does the Appeals Court mention why it accepted this finding of the District Court (400 F.2d 44-50) and barely mentions the mechanical or physical aspect which the District Court found to be an invention—that is, the "reduction of impact pressure" and which the District Court found was discovered and therefore invented by Suess et al. experimenters. (257 F.Supp. at page 48-50).

[375] Although the Court of Appeals affirmed the ultimate determination of the District Court on the grounds that the claims of the Suess et al. patent over-claimed the invention and that the claims cover the prior art (400 F. 2d at page 38), its determination held that it was "unnecessary to consider the correctness of every ruling of the District Court" (400 F.2d at page 38). Nevertheless, it went on to say that,

> "On the other hand a consideration of the factual background of this case and of the errors we find in the District Court's ruling on obviousness will aid in understanding the reasoning by which this Court has reached its decision." (400 F.2d at page 38).

Following through on this a little more, the Appeals Court in discussing the McLouth contention that it paid $100,000.00 to the plaintiffs for know-how, said that the plaintiffs (appellants) contend that the patentees' new concept "• • • was the direct antithesis of the thinking then prevalent in the steelmaking art". The Court of Appeals said,

> "This penchant of the patentees for creating a verbal antithesis to distinguish every patent that might serve as an interference reference has raised other problems of divining exactly what novel element the patentees claim and how that novel element might be meaningfully distinguished from the prior art." (400 F.2d at page 41).

The Appeals Court then followed through with the statement that the appellants "say that the Suess patent teaches [376] 'avoidance of deep penetration', where the Schwarz and Miles patent taught 'deep penetration'. But 'avoidance of deep penetration' as an abstract phrase means no more to one skilled in the art then does 'deep penetration.' Depth of penetration can gain meaning only from the limitations placed upon it by the patents and from the knowledge that may be attributed to an ordinary worker skilled in the art." (400 F.2d at page 41).

It thereupon took upon itself the attempt "to distinguish inventive experimentation from mere development of know-how in an art with which the Court has no familiarity." (400 F.2d at page 41). It concluded that the ultimate distinction was one of law because it amounts to a determination of obviousness or non-obviousness. It then made a series of conclusions, holdings and findings.

First: The District Court's conclusion of non-obviousness was erroneous because of its failure to comply with the standards set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 17 (1966) since the District Court's conclusion of non-obviousness was based entirely upon the secondary considerations of long-felt but unsolved needs, commercial success and the like. (400 F.2d at page 41).

[377] *Second:* The Court of Appeals did "not have the benefit of a complete determination of the difference between the prior art and the patent in suit or of any findings concerning the level of skill in the pertinent art." (400 F.2d at page 42).

Third: Since "the District Court found three considerations dispositive of the issue of obviousness: (1) the presumption of validity of a patent; (2) the commercial success of the basic oxygen process; and (3) secondary considerations concerning prior attempts and failures at refining steel with oxygen", "under the facts of this case,

neither commercial success nor the presumption of validity will support a finding of non-obviousness." (400 F.2d at page 42).

Fourth: One of the most pertinent prior art patents, the Schwarz patent, was not cited as a reference by the Patent Office, and so far as the record indicates, was not considered by the Patent Office. (400 F.2d at page 43).

Fifth: The Schwarz patent does not teach agitation of the bath by the oxygen stream; so that claim probably would not have distinguished the Schwarz patent *if* it had been before the Patent Office. (400 F.2d at page 43).

[378] *Sixth:* The creation of a licensing structure known as BOT negatives any favorable inference that might ordinarily arise in favor of the applicants. (400 F.2d at page 43).

Seventh: Any problems which might have been involved in deep blowing had existed for a relatively short period of time prior to the 1949 Linz experiments since, other than the Gerlafingen experiments, the record does not disclose any extensive attempts and failures to refine steel by deep blowing of oxygen between 1946 and 1949. (400 F.2d at page 44).

Eighth: Whether the success of the process is attributable to the disclosure of the Suess patent is unclear, because of the arrangements providing for the exchange of know-how and engineering knowledge between the various competitors. (400 F.2d at page 44).

Ninth: The elimination of several potential competitors of the patentees "negates any inference of extensive experimentation and failures by others skilled in the art." (400 F.2d at page 45).

Tenth: The District Court's conclusion that the Schwarz and Miles patents were inoperable did not have much relevance on the issue of obviousness because the District

Court [379] *assumed* that "maintenance of a fluid slag was inconsistent with deep penetration as taught by Schwarz and Miles," and so inter-related this with phosphorus removal, fluid slag, and depth of penetration as such related to the "issue [of] . . . obviousness". (400 F.2d at page 45).

Eleventh: Because the continuation-in-part application was not filed until 1955 " . . . the patentees had the benefit of almost six years of experience in using the basic oxygen process plus whatever information they might have obtained through the BOT arrangement." (400 F.2d at page 45).

Twelfth: The Miles patent contained no specific teaching of deep penetration "but the District Court *implied* such a teaching from the recommendation that the gas should be jetted at a supersonic speed". (Emphasis added) (400 F.2d at page 46).

Thirteenth: The District Court held that "In sum, the only difference between the Suess disclosure and the prior art is the teaching of avoidance of deep penetration as opposed to deep penetration". (400 F.2d at page 46).

Fourteenth: The District Court "should have determined what the prior art taught concerning the necessity of a fluid slag, the method of obtaining a fluid slag, and the feasibility of the suggested method", but the District Court failed to take [380] this further step of concisely defining the difference between the depth of penetration taught by Suess and the limitation on depth of penetration as "clearly defined" by Schwarz and Miles. (400 F. 2d at page 47).

Fifteenth: The claim of the Suess patent does not describe the concept of "avoidance of deep penetration" as the subject matter of the invention and does not distingish it from the prior art, presumably because "it

becomes almost impossible to distinguish 'deep penetration' as taught by the patentees." (400 F.2d at page 48).

Sixteenth: Because the plaintiffs have insisted throughout this case that they regard the *subject matter* of the patentees' invention to be 'avoidance of deep penetration', (400 F.2d at page 49) which is not contained in the claims, the plaintiffs' attempted incorporation of that reference into the term " • • • to an extent to avoid material agitation of the bath by the oxygen stream • • • and to the phrase ' • • • contract of the oxygen with the bath resulting in • • • localized reaction zone spaced a substantial distance from the refractory lining • • • ' . . . can be interpreted as limiting the penetration of the oxygen stream to a 'practically negligible' penetration." (400 F.2d at page 50).

[381] *Seventeenth:* Even though "Conflicts in the evidence, . . . best entrusted to the District Court in the first instance . . ." were not made in this case as related to disclosures of the Miles patent on the question of obviousness "the case need not be remanded for further findings because the District Court can be affirmed on another ground." (400 F.2d at page 48).

Eighteenth: The patentees assumed inconsistent positioning before the patent office and so ". . . the patentees failed to define their alleged advance over the prior art and that in failing to properly limit their claims they attempted to extend their monopoly to something already patented." (400 F.2d at page 51).

Nineteenth: The patentees in the face of prior claim rejections by the Patent Office's inference of abandonment can be drawn from omission of "avoidance of deep penetration" and thus cannot regain the phrase or qualify the effect of their acquiesence through the affidavits because of the file wrapper estoppel. (400 F.2d at pages 54-55).

Again I say that it is not for me to criticize in this most difficult assignment, but it is my obligation to ascertain whether either or both opinions indicate that this was one of those rare occasions in which misunderstanding of technical **[382]** facts and issues occurred. It is for this reason and this reason only that I inquire into what may have been a difference of thinking on the part of the Appeals Court from that of the District Court as indicated in the first place by the opinions themselves, and as these refer to the record for their supports.

Since the holdings in the Opinion of the Court of Appeals, as in the case in the District Court Opinion, necessarily overlap and become cumulative, I shall endeavor to separate these and to discuss them in orderly fashion and also avoid all possible repetition.

First: The finding by the Court of Appeals (a) that the District Court's conclusion of non-obviousness was based entirely upon secondary considerations of long-felt but unsolved needs, commercial success and the like, I refer to Oxygen Compendium XVII where it was obvious that not only Durrer and Hellbruegge at Gerlafingen were experimenting, but that Schwarz, the first patentee and the John Miles & Partner Co., in England were engaged in considerable experimentation. Here we are also informed of the experimentation going on in the United States and of the building, both in the United States and in Europe, of oxygen plants and of the cheap oxygen in Germany, where nitrogen was being produced as a fertilizer and oxygen as a **[383]** by-product. We are told of the list of 30 named experimenters and even more unnamed experimenters in the McLouth Record, PX-308. Whether or not these indicated a long-felt need may be questionable, but that it was an unsolved "need" is unquestionable; (b) as for the commercial success, Drs. Durrer and Hauttmann testified, without contradiction by the defendant McLouth, not only the Gerlafingen test results

but also those of Schwarz and Miles, did not produce commercial quality products.

However, as the Court of Appeals stated these were secondary considerations, but as secondary considerations they would be considered under *Graham* v. *John Deere Co., supra,* only where non-obviousness became an issue of fact. I must, therefore, inquire into these opinions on what was produced as evidence which would support the defense of obviousness, keeping in mind that the burden is upon the defendant to overcome the statutory directive that when issued, a patent is presumed to be valid but such presumption is overcome by clear and convincing evidence. *Oliver United Filters, Inc.* v. *Silver,* 206 F.2d 658, C.A. 10, 1953, cert. den. 346 U.S. 923; *Consolidated Water Power & Paper Co.* v. *Kimberly-Clark Corp.,* 107 F. Supp. 777 (D.C. Wis., 1952), aff'd. 204 F.2d 573, C.A. 7, 1953.

[384] *Second*: As for the holding by the Court of Appeals that it did "not have the benefit of a complete determination of the difference between the prior art and the patent in suit or of any findings concerning the level of skill in the pertinent art", as for the "difference between the prior art and the patent in suit", the McLouth District Court found that ". . . there is admittedly no evidence that steel with satisfactory phosphorus and sulfur content was made commercially by anyone in the 1940's using the oxygen blowing process (R. 13484-13486), despite extensive experimentation by a number of men in several countries of Europe. Such experimentation included a series of tests conducted in Gerlafingen, Switzerland by Dr. Durrer and Dr. Henrick Hellbruegge in 1948 and the Spring of 1949, blowing pure oxygen downward into a bath of molten pig iron, using an afterblow to remove phosphorus after carbon had been removed in the main blow. (DX 61; R. 4915). These tests produced steel satisfactory for some purposes despite "refractory dam-

age and an objectionably high phosphorus content in the steel produced (R. 11929)." (257 F.Supp. at page 379).

The District Court Opinion then contains this

> "For example, when asked by the Court on final arguments: 'Do you concede that the Schwarz and Miles patent would be the most pertinent prior art?', [385] counsel for the defendant replied: 'Certainly the most pertinent patents, yes, your Honor, very much. They are the ones on which we primarily rely.' " (257 F.Supp. at page 387).

The Opinion thereafter recites that the defendant's witness Dr. Durrer testified that the Schwarz patent contained his own ideas

> ". . . yet Dr. Durrer himself required further experimentation with oxygen blowing in Gerlafingen, Switzerland in 1948 and 1949, and even with such experimentation, he did not make steel comparable to that made in Linz by the patentees starting in June 1949 . . . The patentees tried to follow the teachings of Schwarz and Durrer in a series of tests starting in June 17, 1949, but failed to get good results, requiring further experimentation in a series of tests starting June 25, 1949, to get satisfactory phosphorus removal without refractory damage." (257 F.Supp. at page 388).

The Opinion also states that there is considerable evidence in the record that the teachings of the Schwarz patent cannot in fact lead to good results in steelmaking "because the early fluid slag required for satisfactory phosphorus removal according to the specification of the Suess patent in suit is not achieved, with deep penetration of the bath by the jet, as taught by Schwarz." (257 F.Supp. at page 388).

At another time the District Court's Opinion says

> "Schwarz teaches nothing about the avoidance of material agitation of the bath by the oxygen stream

or a circulation of the bath produced by chemical [386] reactions in a localized reaction zone, as claimed by the patent in suit." (257 F.Supp. at pages 390-391).

Further on, the McLouth District Court Opinion recites the differences in the Miles patent and the patent in suit (257 F.Supp. at pages 391-393). It afterwards follows through with a distinction between the Potts patent as against that of the patent in suit (257 F.Supp. at pages 393-394). Afterwards it detailed distinctions or differences between the prior art of Schwarz and Miles and that of the patent in suit (257 F.Supp. at pages 397-398). The Opinion thereafter differentiates with considerable detail and charts the prior art products at Gerlafingen which practiced the prior art of Schwarz as against chemical content at Linz in both the June 17th and June 25th tests, (257 F.Supp. at pages 410-415), and as it produced high quality steel while preserving the refractory life in the vessel.

As for the level of skill in the pertinent art, the District Court Opinion contains considerable references. Earlier the Opinion stated that a defendant's witness " . . . Dr. Flinn admitted that the Schwarz patent, unlike the patent in suit, does not teach specific operating conditions." (257 F.Supp. at page 388). In a footnote at page 386, the District Court found that the defendant admits that the process [387] disclosed in the Suess specification is the same as the process in use at the Linz, Austria plants, and that the Linz process is essentially the same as the process in use at the McLouth plant in Trention, Michigan. (257 F.Supp. at page 386).

As relates to the Linz Suess process, the District Court's Opinion refers to one of the defendant's witnesses in this excerpt

" 'Q. And if you follow those specific teachings, you get good steel; right?

A. Yes.' (R. 7924)" (257 F.Supp. at page 420).

Reference is then made to another McLouth witness, Mr. Johnson who "apparently encountered no difficulty in going from the heat used in the OP-1 shop [at McLouth] to the larger heat used in the OP-2 operation." (257 F. Supp. at page 421).

The District Court Opinion found "In short, according to defendant's own testimony, persons skilled in the art can make satisfactory steel following the teachings of the 36-ton heat example given in the specification, and a person skilled in the art can apparently extrapolate from such conditions to determine the operating conditions for larger heat sizes." (257 F.Supp. at page 422).

In any event, the burden was on the defendant McLouth to prove by appropriate evidence that the necessary skill [383] was not taught in the Suess specification. It failed to do this as was found by the District Court as follows:

> "In sum, the Court finds that the specification of the patent in suit, despite certain indefinite, and inaccuracies, nevertheless complied with Section 112 by disclosing the invention in sufficiently clear terms to enable steelmakers 'to make and use the same.' At least defendant has not sustained its burden of proving otherwise, especially in light of defendant's own testimony that persons skilled in the art could make satisfactory steel following the teachings of the example and that extrapolation to other heat sizes was a simple matter." (257 F.Supp. at page 424).

Third: The holding of the Court of Appeals that "the District Court found three considerations dispositive of the issue of obviousness: (1) presumption of validity of the patent; (2) the commercial success of the basic oxygen process; and (3) secondary considerations concerning prior attempts and failures at refining steel with oxygen"; and that "Under the facts of this case", the District Court could not do this because neither commercial success nor presumption of validity will support a finding

of non-obviousness. While it would not ordinarily be appropriate to inquire into the legal principles as stated, it does become an equitable matter, since the legal principles are coupled with "Under the facts of this case". Under ordinary circumstances, one could not [389] disagree with the Appeals Court in saying that commercial success is not evidence of validity of a patent, or that commercial success is not even proof of an invention. *Continental Can Co.* v. *Crown Cork & Seal Co.*, 415 F.2d 601, C.A. 3, 1969 cert. den. 397 U.S. 914; *Copease Manufacturing Co.* v. *Cormac Photocopy Corp.*, 242 F. Supp. 993 (D.C.N.Y., 1965).

Relating to "commercial success of the basic oxygen process", I assume that this relates to what the Court of Appeals referred to as McLouth's contention that the "lapse" in commercial use of the Schwarz refining process "was due to the unavailability of a method for producing oxygen cheaply in commercial quantities." I shall deal with each of these separately, as they relate to "the facts of this case."

Section 282 of the patent statute, 35 U.S.C. § 1 et seq., provides as follows:

> "A patent shall be presumed valid. The burden of establishing invalidity of a patent shall rest on a party asserting it.
>
> The following shall be defenses in any action involving the validity or infringement of a patent and shall be pleaded:
>
> (1) Noninfringement, absence of liability for infringeement or unenforceability,
>
> (2) Invalidity of the patent or any claim in suit on any ground specified in part II of this title as a condition for patentability,
>
> [390] (3) Invalidity of the patent or any claim in suit for failure to comply with any requirement of sections 112 or 251 of this title,

(4) Any other fact or act made a defense by this title."

In the words of the Supreme Court, the presumption of validity is not conclusive, but it gives the grant of a patent patent substance and value. *Westinghouse Electric & Manufacturing Co.* v. *Formica Insulation Co.*, 266 U.S. 342 (1924).

When the Patent Office issues a patent, it is clothed with the presumption of validity. *Associated Plastics Company* v. *Gids Molding Corp.*, 182 F.2d 100, C.A. 7, 1950. The very issuance of letters patent is prima facie evidence of validity. *Thiberg* v. *Bach*, 107 F.Supp. 639, aff'd. 203 F.2d 956, C.A. 3, 1952.

Oxygen Availability

The Court of Appeals recognized and accepted the District Court's inability to determine when commercial quanties of oxygen . . . would explain the absence of any prior attempts to apply the Schwarz and Miles patents . . . and would thus weaken any inferences as such a lapse in the industry might raise on **[391]** on the issue of obviousness." (400 F.2d at page 42).

Under Oxygen Availability XVII, I discussed the evidence in the McLouth transcript where the defendant's witnesses Dr. Durrer and Dr. Hellbruegge had been working on the application of oxygen upon an industrial scale before 1941 (R.4514). I also said that the defendant's Vice President in charge of Engineering at McLouth, Lyle J. Johnson, stated (R.3443): That there were a number of oxygen tonnage plants constructed which would have been "suitable for this type of usage". The usage referred to was the application to industrial conversion of iron into steel by the use of this process. I said at that time that there was actually no disputed evidence upon which the District Court could have failed to find that there was ade-

quate tonnage oxygen production for industrial usage from approximately 1940-1941. I additionally set forth the fact that one plant in Germany, Sudeutsche Kalkstickstoff Werke, Trostberg, in Eastern Bavaria, had itself up for manufacturing of nitrogen from the air in accordance with the Linde-Fraenkl process; that it had an overabundance of oxygen as a by-product which the German Government Board attempted to use for a low shaft blast furnace using a high concentration of oxygen. I referred to the fact that Dr. Hellbruegge **[392]** testified in this regard (R. 4521); that he and Professor Durrer went to Trostberg in upper Bavaria, where a large low shaft furnace had been built for the production of ferro alloys and that they had available at their disposal, 6000 cubic meters of oxygen per hour. He said that these tests came to a halt on towards the end of the war in the spring of 1945. He said (R.4739) that the work at Trostberg had nothing to do with the refining of pig iron into steel. He later said (R.4745) that the oxygen plant had been used for military purposes in the latter part of 1944, and while he did not know how long that plant had been there, he thought it was "far beyond ten years".

Dr. Durrer also spoke of this (R.5067-8-9) at Gute Hoffnungs Huette and that oxygen enriched air was being used in a low shaft furnace. He had met with Dr. Katwat and Mr. Fraenkl as early as 1929 with relation to this work. I related to the two papers by Dr. Schwarz, included in the record of the case; one in 1949 on a report from Radix Runsheau on the present state of development of oxygen refinings in Sieman-Martin and electric furnaces (DX 182A), and the second, of a report of the steel plant committee of the Association of German Iron and Steelmakers in Genoa, entitled "Blowing of Basic Bessemer **[393]** Pig Iron with a free jet lance", and this was made in 1952 (DX183E). While a discussion had been had in the second paper on the cost of oxygen, Dr. Schwarz did not make any statement that oxygen was not available at an

economically favorable cost, other than the statement that the bottled oxygen of Linde-Fraenkl would be costly at $40.70 as against the $8.82 per ton cost of oxygen by the installation at the Weirton Steel Company at Weirton, West Virginia. These two papers relate, on the whole to, oxygen experimentation.

Although the evidence in the record abundantly shows that oxygen was available for the purpose, there was no evidence that efforts were made to industrialize the Schwarz process application of iron to steel, during the years 1940 through 1952, after the issuance of the Suess patent. I commented there that nowhere was there any complaint that oxygen was unavailable on a tonage basis by the construction of a plant at the site where it was to be used for refining of iron. Supplementally, I presented a number of publications presented to me by the parties in this case which showed these circumstances to be factual. Thus, the scientific facts of the case would not support the Court of Appeals second objection to the question of obviousness that prior patentees who had the commercially successful basic oxygen process, such as Schwarz **[394]** and later Miles, could not have acquired tonnage oxygen for its industrialization in the making of direct refinement of iron into steel.

This then brings us to the consideration of prior attempts and failures at refining steel with oxygen. Again, I refer to that portion of this Opinion entitled Oxygen Compendium XVII, page 360 where the McLouth record is cited to show that there had been at least 30 individuals, who were steel experts including the patentees, Schwarz, Miles and the later experimenters, Durrer and Hellbruegge, Linde and others, and who were engaged in experimentation to find a "remedy or a resolution" of their problems of applying oxygen directly to molten iron and producing an industrially acceptable steel while at the same time avoiding the destruction of the refractories.

Schwarz Prior Art Consideration by Patent Office

Fourth: A patent is presumed valid (35 U.S.C. § 282); however, such a presumption is weakened when the prior art is not considered. *Walden, Inc.* v. *Alexander Mfg. Co.*, 423 F.2d 91, C.A. 5, 1970; *American Seating Co.* v. *Southeastern Metals Co.*, 412 F.2d 756, C.A. 5, 1969. On this premise, the McLouth Court of Appeals found that the failure of the Patent Office **[395]** to cite the Schwarz Patent significantly weakened the presumption of validity. (400 F.2d at page 43).

It said:

> ". . . the Schwarz patent, was not cited as a reference by the Patent Office and, so far as the record indicated was not considered by the Patent Office." (400 F.2d at page 43).

Even though it has been previously discussed, repetition is here warranted that the Schwarz patent was discussed in the Patent Office conferences.

In a footnote accompanying this conclusion (400 F.2d at page 43), the Court of Appeals admitted that there was "mention of the Schwarz patent in the file wrapper [as] contained in the affidavits of Rinesch and Hauttmann," but it said "These affidavits were submitted only about two weeks before the issuance of the patent, and the record does not indicate what, if any, consideration the patent office gave to the affidavits. Such an off-hand reference does not amount to patent office consideration ofthe prior art patent."

Later in the Opinion, the Court of Appeals in discussing another phase considered these affidavits so filed in the Patent Office as something secretly hidden away in these words.

> "Through affidavits submitted to the Patent Office and filed somewhere obscurely in the file wrapper history of the patent" (400 F.2d at page 50).

[396] Taking this last comment first, the patent office in its promulgated rules has provided in 37 C.F.R. § 1.2 that all business with the patent office should be transacted in writing because "No attention will be paid to any alleged oral promise, stipulation, or understanding in relation to which there is disagreement or doubt." Thus the filing of the Hauttmann and Rinesch affidavits by the Suess applicants became a part of the file wrapper history, and as such part of the file wrapper history became as much a part of the record as the continuation-in-part application itself.

Authorization for filing affidavits in cases is provided by two rules, Section 1.131, 37 C.F.R. and Rule Section 1.132, 37 C.F.R. The affidavits, being a part of the file wrapper history are, as the whole wrapper history, held confidential until a final determination is made of the matter, when they become available for public scrutiny. Therefore, the affidavits, as well as the continuation-in-part application and every other section of the file wrapper history were in the same category of treatment, and as such should not be considered judicially as "submitted to the Patent Office and filed somewhere obscurely in the history of the patent."

While Section 1.2 states that it is unnecessary for [397] applicants or their representatives to appear in the patent office, applicants are put on notice that unless the action of the patent office is a part of the written record "No attention will be paid to any alleged oral promise, stipulation or understanding in relation to which there is disagreement or doubt." But that does not deny the applicants the right to interviews with examiners, Rather Rule Section 1.133 (37 C.F.R.) specifically provides for interviews as authorized "in the examiners' room at such times, within office hours, as the respective examiner may designate" and "should be arranged for in advance". That such interviews are a customary and usual proce-

dure in the patent office was testified to before me by former patent commissioners. Cases relating to particularly when file wrapper estoppel exists or does not exist show that these interviews, or as they are frequently called by the courts "negotiations", are in effect a way of life in patent application procedure.

Van der Horst Corp. v. *Chromium Corp.*, 98 F.Supp. 412, 420 (S.D.N.Y.-1951); aff'd. 197 F.2d 791, C.A. 2, 1952.

Texas Co. v. *Anderson-Prichard Refining Corp.*, 122 F.2d 829, (CAID-1941).

Westinghouse Electric Corp. v. *Hanover Chemicals Mfg. Co.*, 179 F.2d 293 (CA3-1949).

However, the file wrapper history in this case is not devoid of a recording that (PX2A, at page 74):

[398] "The claims of the application are cancelled and new claims 17 and 1 are substituted therefor in view of the discussion with the Examiner on May 1, 1957.

The new claims are presented in view of information recently made available and which indicate that the instant application discloses a fundamentally different approach to the refining of pig iron or crude iron by means of substantially pure oxygen and was suggested heretofore. The new claims are believed to be properly definitive of the invention."

In this recording contained in the file wrapper history there is a reference to Schwarz (PX2A, at pages 74-75) as follows:

"The applicants, as early as June, 1949, were familiar with methods of refining crude iron or pig iron proposed by the patentees of the Miles et al. French Patent No. 933,098 and the Schwartz German Patent No. 735,196. The applicants assumed that the Schwartz and Miles et al. methods were suitable for the production of steel of commercial quality and the applicants attempted to use these methods in their early work."

It goes on to state that following the processes outlined by these prior patents that:

> "The early work with these operating conditions was a complete failure because the quality of the steel (if it could be called steel), was very poor and the reaction resulted in rapid destruction of the refractory lining of the converter in which the blowing operations were conducted."

Thereafter the file wrapper history (at page 75) describes the Suess applicants' scientific theory that their process **[399]** brought about a high temperature reaction zone at the central surface of the molten metal bath, when the oxygen impinged upon the metal, under such circumstances as was instructed in the specification.

The file wrapper history then relates the fact that Rudolph Rinesch submitted with a declaration an affidavit supporting the applicants' declaration; and there is contained evidence that this affidavit was considered. This statement was made (PX2A, at page 76):

> "It should be noted that test No. Br 13 is obviously erroneous in specifying a phosphorous content of 0.96% and was not relied on in the affidavit."

It then goes on to say that an explanation of the obviously high P value was requested of the applicants and a cablegram was received as was stated in the file wrapper history.

The file wrapper history continues (PX2A, at page 76) that "A corroborating affidavit by Hubert Hauttmann is enclosed also" and proceeds to discuss the contents of the affidavit as it relates to new claims 17 and 18 as they "properly define the invention and are of a scope commensurate with the invention". It continues to say (at page 77):

[400] "Claim 17, the only independent claim, brings out quite clearly the fact that the stream of oxygen

is discharged vertically downwardly against the surface of the bath without material agitation of the bath by the oxygen stream and that contact of the oxygen with the bath results in a reaction in a localized reaction zone spaced a substantial distance from the refractory lining of the vessel containing the molten iron. Further, the claim asserts that these new conditions result in the refining of the iron and gas evolution and the production of high temperature in the reaction zone *away from the refractory lining.* The reaction in the reaction zone produces a circulatory movement in the molten metal which brings those portions of the molten metal bath remote from the reaction zone into the reaction zone to refine those portions with minimum injury to the refractory lining."

I need only state here that the very fact that it is recorded in the file wrapper history must have been done with the full knowledge of the Examiner. The Court of Appeals stated (in its footnote 6) (400 F.2d at page 43), that two affidavits of two applicants were filed for consideration by the Patent Office with the continuation-in-part application. In the Rinesch affidavit filed in the Patent Office on June 11, 1957 (PX2A, at pages 78-84), it was stated:

"I and Messrs. Suess, Hauttmann and Trenkler started our experimental work on manufacturing steel from crude iron by blowing pure oxygen on the surface of melted crude iron in June, 1949. At that time, we were aware of the state of technology as reflected in the methods now described in German Patent No. 735,196 to Schwarz and French patent No. 933,098 to Miles et al.

[401] The two above-mentioned patents disclose blowing oxygen into a bath of melted crude iron from above providing the oxygen jet with sufficient energy to cause it to penetrate deeply into the bath. The patentees intended to cause the reaction of the oxygen with the crude iron to take place within the bath. Information is not given in the patents about the composition of the crude iron or the analysis of the converted steel, or durability of the refractory lining

of the converter and such information was not available to me and Messrs. Suess, Hauttmann and Trenkler at the beginning of our work."

Then at page 82, this was stated:

"The success of our experiments grew of a departure from the methods disclosed in the Schwarz and Miles et al. patents, which were developed for Brassert & Company while the patentees were employed by that company. I know that attempts were made to manufacture steel in accordance with the patented methods in Italy and that such attempts were not successful."

And finally, (at page 84),

"Inasmuch as our concept of avoiding deep penetration of the molten metal with the oxygen blast is just the opposite of the methods disclosed in the Schwarz and Miles et al. patents and constitutes a major technical advance in the manufacture of steel from crude iron, I believe that our method is patentable."

In the Hauttmann affidavit Page 2, at page 89 of PX-2A, this is said:

(at line 4) . . . "The technological conditions as expressed in the Schwarz German patent No. 735,196 and Miles French patent No. 933,098 which make conversions of crude iron to steel conditional upon the deep penetration of the oxygen stream into the bath, were known to me prior to 1949. **[402]** The patentees intended the oxygen to be carried to all parts of the bath by the agitation or stirring produced by the deep penetration of the bath by the oxygen jet. Thereby the reaction of the oxygen with the crude iron was intended to take place within and throughout the bath by the oxygen seeking out the impurities."

(at line 23) . . . ". . . Messrs. Suess, Rinesch, Trenkler and I started our work in 1949 on the development of a method of refining crude iron with oxygen by utilizing the conditions suggested by Schwarz and Miles."

From page 5 (page 92 of PX-2-A) in the last paragraph:

> "Inasmuch as our concepts of securing purification of the entire contents of the bath mainly by the controlled circulation induced by the reaction center is just the opposite of trying to carry the oxygen to all parts of the bath by agitation produced by deep penetration, as by the methods disclosed in the Schwarz and Miles patents, and constitutes a major technical advance in the commercial manufacture of steel from crude iron, I believe that our method is patentable."

So that while the file wrapper history states that interviews and affidavits clarified the matter before the Examiner, it follows through with many of the details which were contained in the written portion of the affidavits. However, the Court of Appeals considered this as a "void" in the record in these words:

> "Although the record is void as to the content of the discussion with the examiner on May 1, 1957, we believe that an inference of abandonment [403] can be drawn from the omission of 'avoidance of deep penetration' from the final claims." (400 F.2d at page 54).

The difficulty with this statement is that there actually is no "void", even if there is no detailed and minute recording of the interview or "negotiation" between the Primary Examiner and the applicants or their representative. As for the conclusion that "abandonment can be drawn from the omission of 'avoidance of deep penertation' from the final claims", this could not be accurate because at no place in the prior claims did the applicants present an element or factor that comprised or composed the subject matter which stated that "avoidance of deep penetration" was either "the gist of the invention" or an element or factor of the subject matter. The patent particularized the elements or factors as they were contained in the instructions of the specification, and stated that if followed, these would bring results, "while" or "under

such conditions as to " or "related to" avoidance of deep penetration.

In any event, the file wrapper history did reveal for the information not only of the District Court, but also of the Court of Appeals (PX2A, pages 74-75) that the applicants clearly stated to the Patent Office that "the applicants assumed [404] that Schwarz and Miles et al. methods were suitable for the production of steel of commercial quality and the applicants attempted to use these methods in their early work . . . The early work with these operating conditions was a complete failure because the quality of the steel . . . was very poor and the reaction resulted in rapid destruction of the refractory lining of the converter in which the blowing operations were conducted." Thus the patent procedure contained in the file wrapper history shows (as was partially admitted by the Court of Appeals—see footnote, 400 F.2d at page 43) that the prior art of Schwarz patent was considered in the Patent Office, and that with this consideration of Claims 17 and 18, renumbered Claims 1 and 2, were allowed.

Under these circumstances, I believe that technical aspects of the patent were misconceived by the Court of Appeals through its belief that the affidavits filed with the file wrapper in the Patent Office were "obscure" or were a "subterfuge" on the part of the applicants in order to avoid a rejection, and therefore deserves no credibility.

Secondly, I am of the opinion that the Court of Appeals was misguided by the original findings of the District Court that "reduction of impact pressure" was the "avoidance of deep [405] penetration [which] was the gist of the invention". Thus, if the McLouth District Court did mistinterpret the specification itself and arrived at the conclusion that the specification stated that the oxygen jet physically or mechanically produced circulation in the molten bath, and, thereafter made its determination that

the adjustment of the oxygen jet was the invention because it brought about an intermediate impact by the avoidance of deep penetration of the bath as was practiced by prior art; and as such was the gist of the invention—if accepted and followed by the Court of Appeals, rather than as viewing this as the intermediate result of the instructions contained in the Suess specification and a further caution to the operator that if he followed the Suess instructions contained in the specification the results of the prior art particularly "avoidance of deep penetration" would be accomplished—then the original misinterpretation of the District Court would have become threaded into the thinking of the Court of Appeals and the technological comprehension of what was stated in the specification would inequitably result.

I have further proof before me that the indicated record was considered by the Patent Office as such evidence came from Claude A. LeRoy, the Primary Examiner, himself. I need [406] not state all that the Primary Examiner said, but I shall repeat what he stated (PX1002, as introduced at the Post Trial Hearing, at pages 7-8):

> "Q. Did you suggest any language for the claims for the application which you regarded as positive or more positive language?
>
> A. Yes. I thought that the language should try to bring out that the oxygen stream was confined or localized in the area somewhere near the surface of the bath. The deep language, the deep penetration, I thought, was well known in the art. It is a special peneration into the bath, but if you wanted to define this as being localized, I didn't like the language of 'avoid deep penetration.'
>
> So, I suggested that they use something to to show it was localized in that area and I have

> forgotten now what that exact language was. I don't know right now. *I have to refer to the claim.*" (Emphasis added).

The above testimony is given credibility from its source. Although I recognize that Rule 1.2 of the Patent Office requires all correspondence to be in writing, I also recognize that Mr. LeRoy was not testifying from a self serving capacity, a situation for which the rule was evidently promulgated. Rather, as an ex-employee of the Patent Office, he was providing the oral history from the view of that agency.

Neither the District Court nor the Court of Appeals had any help from a record supplement such as I had from the **[407]** testimony of the Patent Office witness in the post-trial hearing before me on April 29, 1970 (FWE at pages 25-26), that the Schwarz patent was discussed with the Primary Examiner and considered at that time.

Fifth: As for the holding by the Court of Appeals that the Schwarz patent does not teach agitation of the bath by the oxygen stream, I refer to Compendium X "Avoidance of Material Agitation" at page 8 where I said,

> "While the Schwarz patent does not use either words 'circulate' or 'agitate' the metal bath, its more limited and fewer instructions, it will be seem, are more or less like those of the later Miles patent in that both advocate the introduction of the oxidizing agent or fuel into the interior of the bath."

I referred to the Schwarz direction for introducing the jet of gas "with such a high kinetic energy that it is capable of penetrating, in the manner of a solid body, deep into the bath . . ."

But while the Schwarz patent did not in so many words say that the oxygen stream was to be used to agitate the bath, it did teach agitation of the bath by the oxygen

stream by its insertion or injection into the bath "in the manner of a solid body".

In a footnote I indicated that a "solid body" would indicate a huge spoon or other device for manipulating the [408] "agitating" or "stirring" of the bath. I quoted Miles as saying that (Id. at page 11) "The jet serves to circulate and agitate the metal and the slag . . ."

Sixth: The Court of Appeals found that there could be no competitive action on industrial functioning on the Schwarz patent because VOEST had tied all of the steel companies into an association known as BOT. The record indicates that while the steel companies in England and in Europe, as well as in the United States, were experimenting with oxygen application to iron processing, none of them had perfected its use for processing on an industrial scale or level.

A series of letters in evidence indicated certain understandings among the parties and who the parties were. Thus in a letter dated June 6, 1949 (DX86-E), from General Management of "Osterreichisch-Alpine Montangesellschaft to Dr. Durrer, it was stated that

> "It was decided among representatives of Rollsche Eisenwerke, Gerlafingen, Mannesmannwerke Huckingen, Vereinigte Osterreichische Eisen-und Stahlwerke AG, Linz, and Osterreichische-Alpine Montangesellschaft Vienna, that a mutual exchage of experience in the field of the metallurgical use of oxygen should take place."

This letter then referred to "the use of oxygen in iron and steel plants, such as coke blast furnaces, electric blast [409] furnaces, in melting processes involving converters, open-hearth furnaces and electric furnaces as well as in other metallurgical processes." The four quoted companies were to make their experiences and ideas available to each other free of charge.

In a VOEST memorandum dated May 23, 1949 (DX82-E), it was said that:

> "In conferences in Leoben from May 19 to 21, 1949, it was decided to undertake a mutual study of the question of Oxygen Blowing in iron works by the Von Roll'sche Iron Works Gerlafingen, Huettenwerk Huckingen, Ag., Alpine Montangesellschaft Donawitz and VOEST Linz."

The procedure was outlined in five points:

1. All experience and know-how to be at the disposal of the plants, reciprocally.

2. The tests were to be carried out and financed by the individual plants which conducted them, with certain exceptions which are here irrelevant.

3. Another conference was to take place in four to five weeks in Linz.

4. Future tests would be begun in Huckingen and in Linz with the blowing of pure oxygen in converters or vessels suitable for that process.

5. Dr. Durrer was to act as secretary.

Thus, so far as the record is concerned, each of the participating experimenters continued to operate in their [410] steel industrial plants independently of and apparently competitively with VOEST and each other. In fact we are informed that there was competition within VOEST itself, when Dr. Suess filed an application for a patent in his individual benefit in the summer of 1949 in Germany, concerning which there was litigation in the German Courts.

In a file Memorandum (PX301B) from Gerlafingen dated June 9, 1949, a discussion on oxygen joint work was related as it took place at the Hotel Krone, Solothurn by Managers of the Huttenwerk Huckingen, Dr. Durrer, Manager Gengenbach, Doctor Spillman, Graduate Engineer Jenney and Doctor Hellbruegge, all stated that there had been mention of establishing joint collaboration in which Donawitz,

Linz, Huckingen and Von Roll plants would participate. Each was to make their know-how available without consideration and each plant was to pay by itself for the tests which each carried out, but the results of these experiments were to be made available to all parties.

In the "mentioning" there was a statement to the effect that patent applications were to be filed jointly, together with other circumstances. However, that question was left up in the air at that time.

[411] The participants signed a pledge to guarantee the confidential nature of matters seen and heard (PX-296B). In this memo the parties set up a work schedule which divided the different metallurgical problems to which the individual companies would turn their attention which were:

> Rollsche Eisenwerke was to take over tests involving oxygen refining in the electric furnace.
>
> Huettenwerk Huckingen was to carry out tests for refining Thomas steel with enriched air as well as with pure oxygen.
>
> Apline Montanges was to study utilization of manganese from manganese rich ores.
>
> Voest was to take over tests for producing steel with oxygen from various types of pig iron; the development of a usable vessel and the determination of the proper oxygen-content necessary for carrying out these processes would receive primary consideration.

On the same day, June 27, 1949, there was a Declaration made of the parties present at meetings held on June 26 and 27, 1949, (PX-295-B) in which they declared ". . . that they will neither disclose nor divulge anything outside of their plants concerning the information received or the findings made by themselves in the field of oxygen refining in the course of the meetings at Linz on June 26 and 27, 1949. They were also to use this information and findings within their own plants only in such a manner as to avoid their being passed on to the outside."

[412] On August 18, 1949, the patent situation on oxygen blowing was again discussed. Particularly the Brassert-Schwarz patent, the application of Ludwig von Roll'schen Eisenwerke, and the patent application A1279/49, Class 18B of Dr. Schwarz of Saltzberg "Method and Apparatus for the Continuous Refining of Pig Iron and Steel." It seems to have been concluded that this last would "have to be examined closely after it has been published for opposition since interference with our work can be expected therefrom."

Howver, the very fact that they had a loose agreement to turn over know-how and rights to the use of any discoveries made by any one of them did not prevent any one of them from building a factory, as did VOEST, and from utilizing the know-how of the Suess et al. patent.

But that does not dispose of the question that if Schwarz, particularly, and Miles had had a successful and utilizable patent or patents, as the case might have been, why any of these were prevented from building industrial plants and using oxygen as was advocated by Schwarz. The very fact that they did not do so, and the very fact that they were still experimenting as late as 1952, is some evidence of the fact that neither Schwarz nor Miles had a utilizable industrial instrumentality in their process of **[413]** applying oxygen as the refining agent of crude iron into steel.

While these factual consideration, as the District Court in McLouth stated, are secondary, they must be read in their factual settings as they may or may not aid a just and equitable determination of the questions before me.

In any event, while there were references to agreements on the sharing of know-how experience and rights to function under the discovery made by each of the participants, the record is devoid of commitments as would specifically amount to anti-competitive devices in the business world or to monopolies. These were no different than jointures

allowable by law for the accomplishment of projects cite *McRoberts* v. *Phelps*, 391 Pa. 591 (1950).

Seventh: As relates to the finding by the Court of Appeals that the record does not disclose any extensive attempts and failures to refine steel by deep blowing of oxygen between 1946 and 1949 (400 F.2d at page 44), since I have already discussed the circumstances that the McLouth record when closely examined reveal an abundance of attempts (and failures) to refine steel by deep blowing of oxygen between **[414]** 1946 and 1949; and particularly as was discussed in XVII, Oxygen, I see no further need to elaborate on this phase.

Eighth: As for the holding by the Court of Appeals, whether the success of the process is attributable to the disclosure of the Suess patent is unclear, because of the arrangement providing for the exchange of know-how and engineering knowledge between the various competitors (400 F.2d at page 44), I have already indicated variously, but particularly under Sixth here, that while the four members of the Konsortium had orally agreed to permit all their discoveries to be shared by their competitors, there was nevertheless a showing that, so far as the patent was concerned, there was considerable jealousy even among the participants at Linz itself. Furthermore, Dr. Durrer was not beneath showing his jealousy of the Suess accomplishment, and as against Schwarz with whom he said he had collaborated and that Schwarz had patented his idea in 1937. Dr. Durrer was the defendant McLouth's witness and presented testimony which was more favorable to the plaintiffs in that case.*

[415] The District Court, too, tied this testimony to Dr. Durrer that the Schwarz process was his idea (D.Ct. 257 F.Supp. at page 388) and that the Schwarz patent did not produce good steel (re. to D.C. 257 F.Supp. at page 388).

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* PX-J-16, pages 5100-5101.

In any event, let us assume here, *arguendo,* that the success of the Suess patent was unclear, such as to those who purchased its know-how, such as McLouth and the instant defendant J & L, they would nevertheless have had available to them the Schwarz and Miles patents. Nowhere in the record is there any showing of a rush by steelmakers to adopt the Schwarz and Miles process; while on the other hand, the McLouth record, particularly the District Court's opinion, shows an unmistakable rush by skeptical steelmakers to accept the Suess patent process. These are circumstances which eventually are some evidence, even if secondary, that the success of the process was attributable to the clear disclosure in the Suess patent on non-obviousness. In fact, it was so found by the District Court upon evidence of the McLouth witnesses who stated that they could follow the Suess process and could extrapolate it to higher tonnage furnaces. (257 F.Supp. at page 422).

[416] The McLouth evidence clearly presents a contrast between the non-acceptance of the Schwarz-Miles processes and the acceptance of the Suess process. This is not encumbered by any understandings which had been arrived at by the *Konsortium* of four steelmakers in Europe, particularly as these were involved in mutual jealousies.

I also discussed the reports of Dr. Schwarz in 1949 and 1952, in which he referred to the establishment at Linz of an oxygen steel manufacturing plant, and of the very fact that in these reports Dr. Schwarz, himself, showed no real enthusiastic conviction for his own patent.

Ninth: The Court of Appeal's finding that the elimination of potential competitors of the patentees "negates any inference of extensive experimentation and failures of others skilled in the art" (400 F.2d at page 45), is already fully discussed heretofore.

Tenth: The finding by the Court of Appeals that the District Court's conclusion that Schwarz and Miles patents

were inoperable did not have much relevance on the issue of obviousness because of the District Court's assumption that "maintenance of a fluid slag was inconsistent with deep penetration as taught by Schwarz and Miles"; and so the District Court interrelated this with phosphorus removal, fluid slag and depth of penetration as such related to the "issue of . . . obviousness." (400 F.2d at page 45).

[417] The McLouth record discloses an abundance of evidence that deep penetration of the oxygen jet into the bath produces iron oxides in the interior of the bath and the iron oxides produce high temperatures within the bath while the iron oxides lack contiguity with the slag for reaction of iron oxides in slag upon sulphur and phosphorus. The effort by Schwarz and Miles to produce the iron oxides within the bath served their purpose of saving iron and not lose it in the slag, but it prevented sufficient iron oxides to move into the slag for reaction with sulphur and phosphorus, and made the steel of poor quality because of sulphur and phosphorus content. That this prior art process did not save the refractories was, also a problem for solution by the prior art and the experimenters, until the Suess process solved it. This solution of the problem by Suess then was non-obvious to the prior art.

Since the prior art patents make it plainly obvious that the oxygen is to be injected into the bath and that by these methods of Schwarz and Miles the high temperature is created within the bath, and since there is an abundance of evidence in the record of McLouth that neither Schwarz nor Miles produced good steel because it contained these unwanted and unoxidized elements, it canot be said that the District Court "assumed"; rather the record discloses the technological chemical phenomena involved in these processes to have been **[418]** abundantly supportive of a finding that phosphorus removal, fluid slag and depth of penetration are interrelated and that this had not been obvious to the prior art of Schwarz, Miles and the Gerlafingen ex-

perimenters, because they practiced and preached deep penetration of oxygen into the bath.

Eleventh: The Court of Appeals held that the continuation-in-part application was not filed until 1955, and so ". . . the patentees had the benefit of almost six years' experience in using the basic oxygen process, plus whatever information they might have obtained through the BOT arrangement." (400 F.2d at page 45). As for the information received from BOT, I have already discussed that under this part and the record will disclose that the patentees obtained no benefits from the BOT arrangement, except prior thereto the advice of Dr. Durrer that he believed in the oxygen process and encouraged the Austrians to pursue experimentation in that direction.

It will be remembered that originally the Gerlafingen tests related to the Schwarz patent, was productive of no industrial steel and damaged the refractories. Thus it is obvious that the Suess patentees obtained no information "through the BOT arrangement."

As for the question of what benefits the patentees might have had during the almost six years of experience **[419]** between the filing of the original application in the United States patent office in 1951 and the continuation-in-part application in 1955, an examination of both of these will reveal that they are practically identical. Furthermore, an analysis of all of the claims which were filed indicates that what the claims revealed from the first through the eighteenth was the information which the applicants already had as of the 250th test in 1950. Undeniably then, the first application as it is re-incorporated in the continuation-in-part application has all the information in it that is necessary for a person skilled in the art of steelmaking to use and make the process. To constitute a continuous application, the second application must describe the same invention as the previous one. *E. I. DuPont de Nemours Co.* v. *Union Carbide Corp.*, 250 F.Supp. 816, 821 (N.D.Ill. 1966);

rev. on other grounds 369 F.2d 242, 246 (C.A. 7-1966), cert. den. 386 U.S. 982 (1967).

Twelfth: The Court of Appeals held that even though the Miles patent contained no specific teaching of "deep penetration," yet the District Court "*implied* such a teaching from the recommendation that the gas should be jetted at a supersonic speed." (400 F.2d at page 46).

Semantically speaking, the Court of Appeals may be correct since the specific word "deep" is not contained in the Miles patent. However, the record of McLouth on both sides, as well **[420]** as the wording and arguments of counsel on both sides contain the expression "deep penetration" as being antithetical to Suess, thus labeling the prior art of Schwarz, Miles and the Gerlafingen experimenters. The original application filed by Suess and the continuation-in-part application filed later each contain the synonymous terminology about avoidance of "deep" penetration. Throughout the filed claims, which were either withdrawn or cancelled, from the beginning of the Suess application before the United States Patent Office, similar references to those contained in the patent specification relate to the resultant avoidance of "deep" penetration by the use of the Suess process. And when ultimately the McLouth District Court made its finding of invention it used the words "avoidance of *deep* penetration is the gist of the invention." (Emphasis added) (257 F.Supp at page 393, 408, 428). And this it did antithetically through its expressions that the parties agreed that "the gist of the prior art invention was deep penetration." Specifically, the District Court's words are:

> "The parties agree that the gist of the teachings of both Schwarz and Miles patents is the necessity of penetration *deep* into the bath by the oxygen jet." (Emphasis added) (257 Supp. 398).

Apparently then this was the customary thinking of the prior art as evidenced by the McLouth District Court. It

was reflected in the deposition of the Primary Examiner when **[421]** he referred to the prior art in these words (PX1002, at page 8):

> "The deep language, the deep penetration, I thought, was well known in the art."

He also said this (Id., at page 9-10):

> "It was well understood in the art that deep penetration means a considerable distance into the bath and they wanted to avoid that concept. So I tried to bring their—bring to their cognizance that it was a localized penetration, and so the language which we finally adopted there was to bring out that feature."

Semantically speaking then, the word "deep" is a relative term. In fact, we may consider that the word "deep" is relatively speaking the most superficial of the terminology of "deep, deeper and deepest." But the word "deep" itself does not mean "to the bottom of" or "to the utmost depth of a container or space." It has a specific meaning which is applicable to the contrasting relationship of the prior art and the later the non-deep Suess art.

Webster's New International Dictionary, 1971, at page 589 defines the word "deep," inter alia, as follows:

> "extending far or comparatively far from some level, edge surface or area: as . . . extending downward to a considerable degree . . .; extending well back from a surface accepted as front; having a specified extension in an implied direction usually downward . . ."

Deep is a simple antonym of shallow with especial connotation. That among the synonyms of profound and abysmal, "deep" is in general the less definite term. "Figuratively, therefore, deep applies to that which demands or gives penetration (as deep plots; deep knowledge) . . ." Webster's New Collegiate Dictionary, 1961, pages 215-216.

[422] With these facts and definitions in mind, we may understand that first of all Miles indicated that it was not easy to have the oxygen injected "within the bath," because as he stated the difficulty was that a large amount of the oxygen was lost in the process of attempting to inject it into the bath. It was for this reason that he instructed that injection be had by means of "an oxidizing fluid" and that this be done "at such speed that a sufficient portion of the fluid penetrates into the metal . . .". (PX10A, page 2, lines 5-9). He then stated that "The use of a liquid instead of a gas for the jet is that the liquid has a greater force of penetration into the metal" (Id., at page 2, lines 14-16). He thereafter said, that the high speeds "are desirable in order to obtain an optimum penetration and effect of the fluid, . . ." (Id. at page 3, lines 12-13). He explained that "The penetration of the jet also fulfills the useful function of agitating the bath . . ." (Id. page 4, lines 4-5). He also said "The jet is directed . . . at a velocity which is sufficiently high to assure the penetration of almost all the fluid into the bath. The jet serves to maintain a vigorous agitation so that the oxidizing reactions **[423]** follow one another *in the interior of the bath* at a very speed. . . ." (Id., at page 10, lines 3-7). And finally, he said "The jet serves *to circulate and agitate* the metal and the slag . . ." (Emphasis added) (Id. at page 18, lines 8-9). Schwarz suggested that the jet be introduced in the bath "in the manner of a solid body." In Claim 1 Miles used the words "A process for the refining of molten metal by the projecting of an oxidizing fluid into the metal at a velocity such that a sufficient proportion of the fluid penetrates into the metal . . ." (emphasis added) (Id. page 20, lines 3-5).

Speaking in homely fashion, when one wishes to stir a cup of tea or coffee, the teaspoon is used to "circulate and agitate" the contents. Even the more sophisticated household mix-master inserts the stirring blades sufficiently deep in the bath to "circulate and agitate" the mix for the cakes, etc. So, too, an ice cream maker has its circulating, agitat-

ing or stirring device, deeply enough into the container to produce its smoothness. A butter churn is another example. I think these explain what Miles, in desiring to have the metal bath "circulated and agitated," indicated that the oxidizing fluid had to enter and had to penetrate "deep" enough into the bath to produce such reactions. So it is that in deep penetration of the prior art, the iron is saved, but while the iron is saved, it is not permitted **[424]** to perform its function as iron oxide and entrap the sulphur and phosphorus and transfer them into the slag.

Here then I firmly believe is proof that it is dangerous for anyone contemplating the patent to either minimize or entirely disregard any of its component parts. There is no doubt that an individual practicing the teachings of Schwarz, Miles, Durrer or Hellbruegge would avoid slopping by penetrating deeply into the bath while he would be retaining more iron, but at the expense also of the retention of sulphur and phosphorus in the iron.

In contradistinction the Suess process permits the iron oxides to early flow into the slag as well as into the metal bath, and it does that by creating a pocket or indent which has been spoken of as the localized reaction zone at the top central surface of the bath, where the oxygen and metal make impingement contact, and where chemical oxidation or reaction occurs in accordance with the explanations contained in the Suess patent. In fact the specification explains how this is to be done and that when it is done, it

> ". . . produces a sufficiently high reaction velocity of the oxygen with the bath constituents to insure the development of autogenous heat at a rate sufficient to provide the heat required for completion of the refining in a minimum of time, consistent with controlled temperature and control and development of other necessary and required process conditions, such as fluid slag, avoidance **[425]** of over oxidation (undue loss of iron to the slag), and avoidance of slopping. The process conducted under these conditions avoids a deep pene-

tration of oxygen gas into the molten bath which seriously impairs refractory life at the bottom of the refining vessel." (PX1, col. 3, line 64 to col. 4, line 1) (See R. 819-821).

So it is that by reason of such impingement contact of oxygen to metal in the chemical oxidation reaction center at this place, the high temperatures are created and controlled, primarily, exothermically, as to permit the process to avoid slopping and the iron oxide to remain in proximity with both the slag and metal bath until the high temperatures diffuse it into the slag and also into the metal bath, where it dissipates its heat or high temperature into the bath as the secondary function within the bath and outside of the localized reaction or high temperature zone, endothermically, as the secondary part of the conversion process. This is actually the much overlooked key to the successful results of the Suess process.

The Appeals Court said,

> "*Assuming* that 'avoidance of deep penetration' defines some meaningful concept, the claim of the Suess Patent does not describe that concept as the subject matter of the invention and does not distinguish the alleged invention from the prior art." (Emphasis added) (400 F.2d at page 48).

The Appeals Court then went on to say,

> "Apparently the patentees were *aware* that, when it is once admitted that the oxygen jet penetrates into the bath to any not insubstantial degree, it becomes almost impossible to distinguish 'deep **[426]** penetration' as taught by Schwarz and Miles from 'avoidance of deep penetration' as taught by the patentees. The various patent applications on the L-D process reflect this difficulty." (Emphasis added) (400 F.2d at page 48).

Thereafter the Appeals Court cited instances: that when confronted by an interference by the Schwarz patent for a German patent, Dr. Suess replied,

> " 'In contradistinction to * * * Schwarz in the case of the present invention the molten bath is blown with so little kinetic energy that the oxygen does not penetrate. * * *'." (400 F.2d at page 48).

Again, Dr. Suess stated,

> " '* * * the oxygen is not blown into the molten bath, but rather onto the surface of the bath and reacts at the surface. * * * The jet of oxygen * * * acts only on the surface. * * * .' " (400 F.2d at page 48).

In their Australian application, the patentees stated that,

> " '* * * the gas jet does not penetrate into the bath of molten metal * * * and further an essential characteristic of the invention is that the gas jet does not penetrate into the bath * * *.' ". (400 F.2d at page 48).

In other applications the Appeals Court said,

> ". . . the amount of penetration was not even urged as the gist of the invention; rather the patentees contended that the good results of the L-D process were due to the maintenance of a proper ratio between the bath surface and bath depth.' " (400 F.2d at page 48).

Actually, the Suess et al. patent never in any of its prior applications, and in the continuation-in-part application, prescribed anything more than "impingement" of the [427] oxygen jet upon the center surface of the bath, the placement at the center surface of the bath of the "localized reaction zone," and as these were reflected in the claims of the oxygen being discharged "through the slag layer onto and below the surface of the bath at the central portion thereof . . . the contact of the oxygen with the bath resulting in reaction . . ."

Thus, in seeking a gauge by which the "deep penetration" as taught by Schwarz and Miles (400 F.2d at page 48) the Appeals Court not only discarded words but dwelt upon the term " 'practically negligible' penetration." In effect

it went outside anything advocated in the specification as summarized in the claims, and amplified phraseology used in the affidavits accompanying the continuation-in-part application.

As for the suggestions by the Appeals Court that "Even if 'avoidance of deep penetration' could be given a broader meaning than 'a practically negligible penetration' . . ." (400 F.2d at page 51), the file wrapper estoppel as found by the District Court "prevents the claims from being read so as to contain that limitation," and "the patent must be held invalid." (400 F.2d at page 51).

Since I have detailedly discussed the file wrapper estoppel question elsewhere (Compendium II), I need only note that the Appeals Court could only be guided **[428]** by the *sua sponte* thinking of the District Court and of the record which it had in that connection.

In reviewing the District Court's decision in that regard and the record, the Appeals Court said that,

> ". . . the determinative question on this issue is whether the Appellants did in fact cancel, surrender, or abandon the claim of 'avoidance of deep penetration by the oxygen stream' during the prosecution of Patent Application No. 547,233." (400 F.2d at page 52).

Yet, in reviewing the various applications and claims prior to the issuance of the patent, the Appeals Court stated that in the 1951 application,

> "No claim referred to avoidance of deep penetration as an element of the process." (400 F.2d at page 53).

And in Claims 1 through 15 that

> ". . . the Examiner did not mention avoidance of deep penetration directly as a conflicting element." (400 F.2d at page 54).

In this regard, as I stated elsewhere, prior to the issuance of the final patent, in the negotiations with the Primary Examiner (First post-trial hearing Compendium II), it was noticeable that at no time was the term "avoidance of deep penetration" discussed as a "conflicting element." Rather on the testimony particularly of the Primary Examiner, it was obvious that everyone knew that prior art practiced deep penetration, but that this Suess patent was attempting to word the "differentiation" from the prior art, particularly Miles, by emphasizing the surface activity of the oxygen and **[429]** metal in a "localized reaction zone." If this evidence had been before the District Court and there had been no need to provide a *sua sponte* decision in that regard, it is quite likely that the Appeals Court would not have said,

> "Although the record is void as to the content of the discussion with the Examiner on May 1, 1957, we believe that an inference of abandonment can be drawn from the omission of 'avoidance of deep penetration' from the final claims. In our opinion, if the element was as important as the affidavits imply, it would have been explicitly included in the claims; . . ." (400 F.2d at page 54).

It is obvious, then, that the real importance of the wording was not one of similarity to prior art but of the differentiation between the Suess et al. patent and the prior art. As well, the significance of placing the oxygen jet at the surface center of the bath, was not a matter of limitation of patent claims, but rather a clarification wording by the use of appropriate words as adopted in the words "blowing with oxygen, which comprises discharging a stream of oxygen vertically downwardly through the slag layer onto and below the surface of the bath at the central portion thereof, to an extent to avoid material agitation of the bath by the oxygen stream, the contact of the oxygen with the bath resulting in reaction of the oxygen with a portion of the iron and with the oxidizable impurities of the bath in a localized reaction zone . . ." (Ex.PX1, col. 12, lines 12-19).

[430] Again it would have facilitated the review by the Court of Appeals if the evidence, particularly of Primary Examiner LeRoy had been before the District Court, and it would then not have been required to make this statement,

> "In this case the issue of file wrapper estoppel hinges entirely upon the factual determination of abandonment or non-abandonment." (400 F.2d at page 54).

Except for the fact that the claims throughout this patent proceeding in the United States Patent Office, made the distinction in the deep penetration of the prior art and the avoidance of that deep penetration in the Suess et al. application as they were required to set forth the differentiation by law, none of the claims "particularly pointed out and distinctly claimed 'avoidance of deep penetration' as the subject matter which the applicants regard as their invention"; and that, further, as such the applicants never claimed " the gist of the invention" to be "avoidance of deep penetration" or "reduction of impact pressure".

The Appeals Court said,

> "Appellants have *insisted* throughout this case that they regard the *subject matter* of the patentees' invention to be 'avoidance of deep penertation'." (Emphasis Added) (400 F.2d at page 49).

Thereafter it referred to the requirements of Section 112 relating to claims, and then recited the two claims contained in the patent. Thereafter, it said,

[431] "No express reference to 'avoidance of deep penetration' is made in the claim." (400 F.2d at page 50).

I raise the question here then, if and since Section 112 commands that the claims must contain the subject matter particularly pointed out and distinctly claimed, which the applicant regards as his invention, why would the applicants "have insisted throughout this case that they regard the subject matter of the patentees' invention to be 'avoidance

of deep penetration'."! This question is all the more emphasized when we know that it is the lawyers who conduct "the case" and that undoubtedly the lawyers in this case were experts in the handling of patent cases.

In my in-depth examination of this case, I have endeavored to find where the Suess patentees have claimed that "avoidance of deep penetration" is the *subject matter of the patentees invention.* In my close and repeated scrutiny of the record I have found many places where the plaintiffs have insisted at McLouth that the big *difference* between the Suess et al. patent and the prior art was that the Suess et al. patent avoided "deep penetration"; but nowhere was I able to find that it was its subject matter.

In this same connection the Appeals Court charged the McLouth plaintiffs with attempting "to incorporate the term in the claim by relating it to the phrase '*** to an extent to avoid material agitation of the bath by the [432] oxygen stream ***' and to the phrase '*** contact of the oxygen with the bath resulting in *** a localized reaction zone spaced a substantial distance from the refractory lining ***'." (400 F.2d at page 50). It then found "yet neither of those phrases can be interpreted as limiting the penetration of the oxygen stream to a 'practically negligible' penetration." (400 F.2d at page 50).

I have discussed elsewhere, and on several occasions, that if the patentees had intended that "avoidance of deep penetration" was the "reduction of impact pressure" from the prior art of Schwarz and Miles, and that if this was the factor which was "the gist of the invention", it would have been required to have been stated in the specification and claims. Yet nowhere in the specification are these stated, nor were they ever stated as factors in any prior application filed in the United States Patent Office. What the specification does state, as reflected in the claims, as I have so often repeated, a series of instructions, which if followed as asserted in the specification, will result in "avoidance

of deep penetration", or certain effects result, although the oxygen jet does not penetrate . . ."

As for the matter of the phrase "to an extent to avoid material agitation of the bath by the oxygen stream", as it was discussed by the Appeals Court, it is apparent that the [433] *sua sponte* decision by the District Court carried through to the Appeals Court, and it was unaware, as was the District Court, of what had occurred in the Patent Office in the several weeks before the patent was actually issued, as this was related by the Primary Examiner (Ref. here to first post trial hearing Compendium II).

As for the Appeals Court consideration and discussion and interlinking of the term "practically negligible penetration", I believe from my study of the specification itself that the Court of Appeals, like the District Court, was unaware of the significance in the technically chemical functioning of the impingement of the oxygen jet upon the metal bath surface with its further technical chemical consequences. Neither was it aware of the chemistry significance of the terminology in the claim of the discharge of the oxygen "vertically downwardly through the slag layer *onto and below the surface of the bath* at the central portion thereof, to an extent to avoid material agitation of the bath by the oxygen stream, the contact of oxygen with the bath resulting in reaction . . ."

Since I have already elaborated on this phase of the impingement of the oxygen jet and its chemical generation of reactions, I need repeat here only that it would seem that by the instructions contained in the specification within its limitations as prescribed, the impingement of the jet [434] onto the surface of the liquid bath causes an indent which lies linearily below the surface of the bath (which witnesses testified contained the localized reaction zone), and certainly would satisfy the description by one of the applicants of the wording that their patent was limited to a " 'practically negligible' penetration or to a 'surface layer' pene-

tration" (400 F.2d at page 49); that the chemical interpretation between the oxygen atoms and the iron atoms violated the surface linearity of the molten metal, and that the words in the claim "onto and below" taking color from each other, placed the position of the jet in relationship to the surface and thus would also satisfy the words of limiting the jet penetration "to a 'practically negligible' penetration or to a 'surface layer' penetration."

Convinced of the idea that the patentees did make "avoidance of deep penetration" the "subject matter" of their invention the Court of Appeals concluded that even when read in the light of the specificaion, "these claims would not describe 'practically negligible' penetration to one skilled in the art. Hence, the patentees failed to describe their invention." (400 F.2d at page 50).

In relating its thinking about avoidance of deep penetration, the Court of Appeals restated what the District Court said that both Schwarz and Miles placed the same limitation on depth of penetration as it related these prior [435] arts to "*** a localized reaction zone spaced a substantial distance from the refractory lining." The difficulty of this thinking, as was pointed out under Compendium VII, was that the prior arts both placed the localized reaction zone on the *inside* of the bath; whereas Suess placed it on the *surface center* of the bath, and *depth* of penetration had no place in the instructions for the placement of the top center of the localized reaction zone in the scheme of the Suess process. Rather, the instructions on vertical, central placement of the nozzle, diameter opening of the nozzle, atmospheric pressure of the oxygen jet, distance from the bath and ratio of bath depth to area surface, were the instructions when followed which controlled impingement or control with the metal surface of the bath, without anything more. This the specification related variously throughout its instructions and explanations.

This, then, does not support the statement of the Court of Appeals that,

> ". . . in the instant case we are concerned with the patent *that varies from the prior art only in the alleged degree of penetration of the oxygen stream.*" (Emphasis added) (400 F.2d at page 51).

As stated elsewhere on many occasions, if avoidance of deep penetration was the only element involved in the Suess patent, then why would there have been any need for any other instructions including those past repeated here? **[436]** The Court of Appeals also stated,

> "As indicated earlier the specifications nowhere establish a standard for determining when agitation becomes material and nowhere relates the amount of agitation to the depth of penetration. . . . Whatever interpretation one skilled in the art might have placed on 'avoidance of material agitation', it would not have been the 'practically negligible' penetration that the patentees represented to the Patent Office as 'avoidance of deep penetration.' " (400 F.2d at page 51).

In coinciding these two ideas, it is apparent that the Court of Appeals did not have the thinking of the patentees that "material agitation" represented in part only the deep penetration as it provided the stirring, circulating or agitating action by the jet in the inside of the bath in the prior art of Schwarz and Miles. Thus, even if the specification of Suess or its claims contained the words "avoidance of deep penetration", its obvious significance would be, as it was found by the Primary Examiner, not one of degree of avoidance of penetration but of not injecting the oxygen jet so as to make it function on the inside of the bath.

We know, too, that neither Schwarz nor Miles provided for measurements of the recommended penetrations, rather both indicated simply that the oxidizing agent was to be injected into the bath, or into the interior of the bath and that was all. In any event, both Schwarz and Miles made us

aware of the fact that it could not be an impingement contact of the **[437]** oxidizing agent with the surface of the bath, but rather that the oxidizing agent had to be injected into the bath.

This then brings us to the *twelfth, thirteenth, fourteenth, fifteenth, sixteenth, seventeenth,* and *nineteenth* findings of the Court of Appeals which generally dealt with the matter of "avoidance of deep penetration" in its various phases of lack of explanatory differentiation from the prior art, lack of definition and limitation, lack of description of this phase as the subject matter of the invention, expanding this phase from the position of the applicants of a "practically negligible" penetration, and of the eventual abandonment of that phase of the claimed invention.

Deep Penetration Rulings

The Court of Appeals stated that the concept of avoidance of deep penetration

> "as an abstract phrase means no more to one skilled in the art than does 'deep penetration'. Depth of penetration can gain meaning only from the limitations placed upon it by the patents and from the knowledge that may be attributed to an ordinary worker skilled in the art." (400 F.2d at p. 41)

While the "Depth of penetration can gain meaning only from the limitations placed upon it . . .", when the frame of reference is changed from an abstract concept of "depth" qua **[438]** "depth" to depth in relationship to a converter vessel, the concept takes on a relative meaning. It is true that the patentees did not specify (as did not the prior art patentees) that one should penetrate one inch, five inches or twenty inches; however, it must be realized that they could not so specify because of the variation in size of steelmaking vessels—and that such knowledge would become encompassed in the expertise of the steelmaker. In fact the evidence of the defendant's steelmakers as reported

by the District Court admitted that a person skilled in the art could follow the teachings of the examples set forth in the specification and manufacture satisfactory steel; that the specification's teachings cover larger or smaller heats; that the teachings of the specification provide sufficient guidelines to persons skilled in the art desiring to manufacture steel in heats sizes of other than 36 tons; that "... according to the defendant's own testimony, persons skilled in the art can make satisfactory steel following the teachings of the 36-ton heat example given in the specification, and a person skilled in the art can apparently extrapolate from such conditions to determine the operating conditions for larger heat sizes." (257 F.Supp. at page 420-422). This satisfies the law, because the specification is to be addressed to those skilled in the art and is to be comprehensible by them. It may be, sufficient, though the unskillful may not be able to gather from it how to use the invention and it is evident **[439]** that the definiteness of the specification must vary with the nature of its subject. *Mowry* v. *Whitney,* 14 Wall. 620, 644 (1872); 81 U.S. 620, 644.

Thus while the specification does not contain inch or meter direction, the depth of penetration is controlled by the instructions in the specification of working within limits of height of nozzle from the bath surface, limits of nozzle opening diameters, limits of ratio of bath depth to bath diameter, and vertically, central placement of nozzles. Thus the specification tells us that the process controls the depth of penetration so as to create a "localized reaction zone" where the high temperatures are created and whence they are chemically diffused or impelled. These fully detailed by clear instructions and examples contained in the specification point out the limitation of the invention of blowing an oxygen stream at a pressure between 5 to 25 atmospheres vertically downwardly, through the slag, onto and below the surface of the bath at the central portion thereof, but only to such an extent as to avoid material agi-

tation of the bath by the oxygen stream so that when the contact of oxygen is made with the bath a chemical reaction results, *at the place of impingement*, whereupon the oxygen combines with the iron and oxidizable impurities of the bath, in what the specification calls the localized reaction zone spaced substantially away from the [440] refractory bottom and walls.

The specification is specific in describing the reactions which result in the exothermic iron gas evolution which produces a high temperature away from the refractory lining. It also causes the first activity which eventually produces a circulatory movement in the molten bath with endothermic chemical reactions, which also bring the other portions of the metal bath remote from the reaction zone into the reaction zone where they are subjected to the reaction in the localized impingement area for continuing chemical reaction as long as oxygen and oxidizable elements exist for chemical combination and all of this with minimum harm to the refractory lining.

Dr. Hauttmann one of the patentees and Dr. Elliott one of the plaintiffs' experts asserted that a steelmaker under the teachings of the specification knows when he is avoiding deep penetration within the meaning of the patent, when he does not blow deeply enough to cause refractory damage or to prevent the formation of a fluid slag (R. 6168-6170; R. 2764). The District Court gave its approval and stated that "... such process conditions as a fluid slag, the avoidance of slopping and the avoidance of refractory damage are admittedly part of the practice of steelmaking at McLouth." (257 F.Supp. at page 422).

Thus, a steelmaker skilled in the art he is practicing is made aware of what the character of penetration means in [441] regard to the particular vessel with which he is working and the potential pitfalls of the different prior art.

While this limiting parameter, which in part differentiates the Suess patent from the patents and teachings of

the prior art, is "avoidance of deep penetration", it is one which does not require definition by a ruler, but rather by all the instructions of the patent; since it is the entire teachings of this patent which reflect the difference between it and prior art practices and an admonition to avoid the prior art practices, not necessarily inclusive of only one prior art misuse of character of penetration into the bath for the purpose of stirring, circulating or agitating its contents.

The testimony of Dr. Hauttmann at the *McLouth* trial illustrates the difference between the present patent and the prior art. Dr. Hauttmann testified that, "The information received by Dr. Suess from Dr. Durrer and the information received by Dr. Trenkler from Mr. Hellbrugge was to the effect that the oxygen was to be blown through a nozzle deeply into the bath, in which case, as far as I remember, the nozzle was to be positioned at an angle; and on the basis of these suggestions, it was intended to accomplish what Lellep wanted to accomplish in his process and what Schwarz wanted to accomplish by blowing from above into the bath." (PX424, at page 2224).

[442] In summarizing the result of the test conducted at Linz in June of 1949 Dr. Hauttmann stated: "the test series which had been started on the 25th of June had shown us in its results that it was not correct to blow the oxygen, in accordance with the then teachings, deeply into the melt, and that a success can only be expected—by 'success' I mean application of this process in practice—if the process is carried out in such a way that the oxygen is blown from the nozzle vertically downwardly on the center of the bath's surface in order to create a hot reaction field in the upper region of the bath and by maintaining that hot spot at a corresponding distance from the lining." (PX 424 page 2250).

In summarizing the prior art and specifically the teachings of Durrer and Hellbrugge, Trenkler testified that if

one were to practice the teachings of Durrer-Hellbrugge he would "Go with the nozzle as close as possible to the surface of the bath and blow so strongly that you get with your jet into the lower regions of the bath and so guarantee the stirring of the bath with the oxygen jet." (PX 508 page 11910). (See also DX 5, DX 8, DX 251E).

Dr. Trenkler further dramatized the fact that prior to the work at Linz, the thinking of those skilled in the art of steelmaking revolved around the concept of deep penetration. In speaking of his conversations with Drs. Durrer and Hellbrugge at Gerlafingen, Dr. Trenkler testified "They told **[443]** me that the tests had been carried out as small as possible a distance of the nozzle from the bath and that that was the thing to do in order to blow the oxygen jet into the lower regions of the bath, *in order thus to insure a mechanical movement of the bath* and in order *to obtain a low iron content in he slag.*" (Emphasis added) (PX 508 page 11805). Dr. Trenkler further testified on cross-examination concerning the teachings of Doctors Durrer and Hellbrugge that "Their opinion and their teaching is that the oxygen jet has to penetrate into the lower regions of the bath so that a corresponding bath movement by the oxygen stream will be insured and a low iron content of the slag can be obtained." (PX 508 page 11894).

Dr. Trenkler also discussed an article written by Dr. Hellbrugge (M DX 61). On page 5 of the English version of that article it is stated "Therefore, in order to be able to operate with pure oxygen it becomes necessary to abandon the heretofore used method of blowing through the bath and to blow the oxygen onto the bath. The blowing onto the bath must not be done with too little pressure as otherwise there will only be a surface reaction. This means that too much oxygen is lost, the refining takes too long a time, and the iron content of the slag will be too high." (PX 508, page 11947).

Thus, while the Court of Appeals found the only difference **[444]** between Suess and the prior art to be the con-

cept of avoidance of deep penetration and that its obviousness rested on that of fluid slag maintenance, the significance of this admonitory concept must be understood in the context of the teaching as a whole. By practicing the teachings of blowing vertically onto and below the central surface, and being careful to avoid deep penetration, one practices Suess rather than the prior art.

The Court of Appeals found that "The characteristics of the process that would place limitations on the depth of the penetration and that would meaningfully define the depth to one skilled in the art were found to be slopping, refractory damage, and fluidity of the slag." (400 F.2d at page 47). There is no doubt that these elements are important variables with which the patentees concerned themselves. The Appeals Court then continued that since the District Court found that the teachings of both Schwarz and Miles likewise involved avoidance of slopping and preservation of the refractory life, that the only differentiation between Suess and the prior art is the necessity of forming and maintaining an early fluid slag.

By this excerpt of the Court of Appeals, we are confronted with a one-sided view of what may happen when an insufficient impingement or contact is made by the oxygen stream or jet **[445]** with the molten metal bath that has been referred to in many places throughout this Opinion Compendium and in the opinions of both the McLouth District Court and Court of Appeals as slopping occasioned by an insufficient contact of the oxygen with the metal. Here the contact of the oxygen is made less with the metal and more with the slag, while in the prescription of the Suess patent the operator is instructed to direct vertical pressure through the slag and make impingement contact with the metal and so produce its results.

This last excerpt seems to have overlooked another fact that in the prior art of both Schwarz and Miles as well as that at Gerlafingen, the intention was to retain the iron

in the bath and not lose it to the slag. As Dr. Trenkler quoted Dr. Hellbugge, if the lighter application of oxygen is made in accordance with the instructions contained in the Suess specification an early fluid slag is created by reason of the entry into the slag of iron oxides, which in turn react upon sulfur and phosphorus. But evidently from what the steelmakers say, the unobvious expertise manifested by the Suess patent was conceiving how to create and maintain a fluid slag retaining a high content of iron in the bath. This the prior art never taught and was never able to do.

[446] One additional matter to which the Court of Appeals referred to in Footnote 11 (400 F.2d at page 48) inferred that the Gerlafingen blowing experiments were hampered because it did not have an oxygen plant, and because other factors made experimentation "cumbersome". The statement was made that Linz had "better conditions". There is no evidence in the record that the Linz experimenters possessed an oxygen plant during their experimentation period from early June, 1949 to the end of November, 1950. Their equipment was also home-made as is evidenced by the fact that in the first test the nozzle melted, and in the second test that the water surround broke and sprayed the metal. There were also indications that the experimenters were making make-shift appliances and improvement during the course of their experimentation. Thus, this character of evidence neither adds nor detracts from inventive discoveries which the Linz experimenters made as against the failure of the Gerlafingen experimenters to make inventive discoveries.

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Patent Validity, Breach of Contract and Infringement[1]

[1] The J & L defenses in these actions to a large extent parallel the *McLouth* defenses. Primarily, it is alleged that the Suess et al. process is an imitation of the prior art of Schwarz and Miles. In addition the defendants have raised additional defenses such as anti-trust violations, the Cuscoleca patent, and prior publications which allegedly reveal that the patent in suit was not an invention.

Patent Validity

It is now incumbent upon me to explain the voluminous record in this Court and to make a determination on the validity of the patent in suit.

In its broadly detailed opinion, the *McLouth* District Court scrutinized the many intricate facets of the Suess et al. patent and reluctantly reached the conclusion ". . . that the patent in suit is invalid, not only because of the statutory presumption of validity but also because of the revolutionary nature of the invention disclosed in the specification." (257 F.Supp. at page 441.) Judge Freeman's analysis and reporting represent an enormous undertaking and accomplishment as has been thoroughly discussed under Collateral Estoppel, *supra*. However, what compelled the *McLouth* District Court's "reluctant" conclusion was that despite the presumption of validity and the phenomenal nature of the discovery made at Linz, ". . . the failure of the claims to focus on or limit **[2]** themselves to the precise

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[1]Since extensive relevative details have been fully set forth in the Opinion Compendium filed in this case relating to the question of collateral estoppel in accordance with the guidelines of *Blonder-Tongue Laboratories, Inc.* v. *University of Illinois Foundation et al.*, 402 U.S. 313 (1971), for brevity, I incorporate those relevant and material findings in this Opinion. All record references in this *J & L* opinion are to the *J & L* record. Certain witnesses who appeared before the *McLouth* District Court were not heard here, but their transcribed testimony was presented in evidence either by stipulation of counsel, or by offers of either side.

advance in the art by the patentees renders the patent invalid. Certain elements of the claims are simply not adequately supported by the specification to justify the granting of a patent monopoly in the broad language used. (257 F.Supp. at page 442).

While I concur in many of the findings and conclusions reached by the *McLouth* District Court, there are several areas in which considerable critical disparity exists. To a large extent, these differences arise as a result of the additional evidence which was presented before me, and which was not before the *McLouth* Courts. Additionally, I had the advantage of the scholarly analyses and guidance of both *McLouth* Courts.

It should be observed preliminarily that because so much of this material has been discussed under Collateral Estoppel, the presentation in this section shall be in abbreviated form.

Presumption of Validity

A primary dictate of patent law is that "A patent shall be presumed valid . . . The burden of establishing invalidity of a patent or any claim thereof shall rest on the party asserting it." 35 U.S.C. § 282. A heavy burden rests upon a defendant in a patent infringement suit to convincingly demonstrate that a patent or any of its claims are invalid. *Trio Processing Corporation* v. *L. Goldstein's Sons, Inc.*, 461 F.2d 66, 75 (3d Cir. 1972), *cert. denied* 49 U.S. 997 (1972); *Eagle Iron Works* v. *McLanahan Corporation*, 429 F.2d 1375 (C.A. 3 1970); *Phillips Electronic and Pharmaceutical Industries Corp.* v. *Termal & Elec. Ind., Inc.*, 311 F.Supp. 17 (D.N.J. 1970), *affirmed* 450 F.2d [3] 1164 (C.A. 3, 1971). And, the presumption of validity only will be overcome by clear and convincing evidence of invalidity. *Trio Processing Corporation* v. *L. Goldstein's Sons, Inc., supra; Monsanto Company* v. *Rohm and Haas Company*, 312 F.Supp. 778 (E.D. Pa. 1970) *affirmed* 456 F.2d 592

(C.A. 3, 1972), *cert. den.* 407 U.S. 934 (1972), *rehearing den.* 409 U.S. 899 (1972). See also: *Stamicarbon, N.V.* vs. *Escambia Chemical Corporation*, 430 F.2d 920 (C.A. 5, 1970); *Boas Box Company* v. *Proper Folding Box Corporation*, 330 F.Supp. 401 (E.D.N.Y., 1971).

A. Anticipation

It is provided in 35 U.S.C. § 102, inter alia:

> "A person shall be entitled to a patent unless—
>
> "(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for patent, or
>
> "(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of the application for patent in the United States . . ."

The defendant alleges that the Suess patent is invalid under Sec. 102(a) and 102(b) because the alleged invention was patented or described in prior printed publications, namely: (1) the Schwarz German Patent No. 735,196 (DX-5 and 5-A); (2) the Miles patents;[2] (3) the Von Roll Plant News (DX-163), and (4) the Strassburger & McGarrity "Report on Investigation of European Steel Plants" (DX-168).

[4] 1. The Schwarz Patent (DX-5A)

The Schwarz German patent, No. 735,196 published July 3, 1943 (DX-5A) discloses a concept of jetting oxygen

[2] Three Miles patents which are substantially identical in nature have been presented here for consideration. They are (1) the Miles British Patent No. 642,084 (DX-8); (2) the Miles French Patent No. 933,098 (DX-9 and 9A), and (3) the Miles Belgian Patent No. 468,316 (DX-10 and 10A). Reliance here, is placed on the Belgian patent because of its earliest filing date.

enriched air or pure oxygen onto the surface of the bath with such high kinetic energy that it is capable of penetrating in the manner of a solid body deep into the bath by the use of extremely high velocities lying preferably above the speed of sound, and thereby providing a means for refining pig iron into steel (DX-5A, p. 2 lines 7-8).

The defendant alleges that it was practicing the prior art of Schwarz,[3] and alleges that as a practical matter, there exists an identity between Suess and Schwarz (R. 4719-20). However, the defendant's witness, Dr. Durrer, testified that the Schwarz method does not produce practical results (PX-510, pp. 5084-85). Dr. Chipman's testimony corroborated this conclusion (R. 528), and further related that to his knowledge, the Schwarz process was never commercially adopted (R. 840).

The Suess patent teaches blowing onto and below the surface of the bath to an extent to avoid material agitation of the bath by the oxygen stream. Dr. Chipman testified that Schwarz on the other hand taught deep blowing (R. 836); did not provide for adequate phosphorus removal (R. 839-840), and produced undesirable wear of the refractory (R. 529). Dr. Chipman further testified that if one blows according to Schwarz, he [5] cannot produce a localized reaction zone (R. 725-731).

The Rinesch affidavit (PX-2A, pp. 78-87) discloses that the patentees were aware of the work of Schwarz and Miles which ". . . made us realize that deep penetration of the bath by the oxygen jet must be avoided, if we were to obtain a high quality iron ,or steel and at the same time, have a satisfactory operating life for the lining of the converter." (PX-2A, pp. 70-80). The Hauttmann affidavit contains similar disclosures (PX-2A, pp. 88-92).

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[3] It will be remembered that McLouth unsuccessfully raised this defense in Detroit.

Dr. Elliott testified that with deep penetration inadequate amounts of FeO are formed thereby preventing the slag from removing phosphorus (PX-504, pp. 6069-74). That is, if the oxygen penetrates deeply, too little of it is available in the slag layer, thereby producing a "dry" or non-fluid slag (PX-504, pp. 6169-70). This dry slag prevents adequate phosphorus removal. This conclusion was verified by Dr. Hauttmann (PX-424B, pp. 2760, 2762-63; PX-424, pp. 2772-73) and Dr. Trenkler (PX-508, pp. 11940-42). Judge Freeman accepted this conclusion [4] based on the testimony of McLouth's Vice-President (PX-473, pp. 3483-86) and its superintendent (PX-471, pp. 6692-93). Dr. Chipman also verified this conclusion from the Linz repetition tests (R. 486-94).

The purpose of the Linz repetition tests, which were conducted at Linz, Austria in 1966, was to repeat the 1949 Linz experiments, and to verify the statements contained in the [6] Rinesch and Hauttmann affidavits. Mr. Trupp testified concerning the circumstances surrounding the tests (R. 1667-1738), and the relevant exhibits are PX-42A through PX-42M and PX 50.

The inoperable prior art references to Schwarz does not negate novelty. *United States* v. *Adams*, 383 U.S. 39, 50 (1966); *Trio Processing Corporation* v. *L. Goldstein's Sons, Inc., supra; Consolidated Window Glass Co.* v. *Window Glass Mach. Co. et al.*, 261 Fed. 362 (3d Cir. 1919). And I conclude, as did the *McLouth* District Court that, "the conclusion is, therefore, inescapable that the patent in suit is not anticipated by the Schwarz patent under 35 U.S.C. § 102". (257 F.Supp. at 391).

2. The Miles Patent (DX-10A)

Because there do not exist any material distinctions between the Miles Belgian, French and British patents, for

[4] See 257 F. Supp. at 389-90.

purposes of discussion reference will be made to the Belgian patent.[5]

While the defendant argues the Miles patent as a separate and distinct defense, the record reveals that the defendant considered Schwarz, Miles and Durrer-Hellbruegge to be essentially equivalent. (R. 4721, 4725-26).

Miles discloses a process of blowing a liquid (DX-10A, p. 2 line 12) composed of from 70% to 98% oxygen (DX-10A, p. 2, line 10, p. 5, line 1) downwardly onto the molten iron bath angularly (DX-10A, pp. 4-7, 9, 13, 14, 17) and preferably at an [7] angle between 30 to 75 degrees (DX-10A, p. 17, line 12) deeply penetrating so as to circulate the molten metal and assure reaction with the oxidizable impurities in the metal. The jet itself performs the function of maintaining vigorous agitation of the bath (DX-10A, pp. 4, 10, 13, 18). Dr. Durrer testified (PX-510, p. 5085) the work of Miles, like that of Schwarz yielded no practical results. As the *McLouth* District Court concluded, ". . . the Miles patent cannot be said to anticipate the patent in suit for a number of reasons: the patent in suit contains specific and detailed operating conditions and teachings either not found in Miles or not recommended by Miles, or contradicting the teachings of Miles; and, further, the evidence in the record indicates that Miles' teachings did not and indeed could not lead to good results in steelmaking comparable to those achieved by the patentees." (257 F.Supp. at page 393). With this conclusion I am in accord.

Thus because both the Schwarz and Miles patents failed to anticipate the patent in question under Sec. 102, if any defense of anticipation is to have merit, it must rest on either the Von Roll Plant News or the Strassburger & McGarrity "Report on Investigation of European Steel Plants."

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[5] The three Miles Patents are British Patent No. 642-084 (DX-8), French Patent No. 933,098 (DX-9A) and Belgian Patent No. 468,316 (DX-10A).

3. Von Roll Plant News (DX-163, Ex. B)

Professor Durrer was a distinguished Swiss metallurgist who had received world-wide recognition for his contributions to iron and steelmaking, particularly in the use of oxygen (DX-245, pp. 5006-5011; DX-248). During the early stages of World War II, [8] Durrer returned from Germany, where he had been a Professor of Metallurgy at the Institute of Technology in Berlin, to his native Switzerland, where he received an appointment at the University of Zurich. At the same time he became Technical Director of Von Roll Eisenwerke, a leading steel manufacturer in Switzerland, which had its headquarters and an operating plant at Gerlafingen, Switzerland (DX-245, pp. 5001-03, 5011).

Commencing in 1947, Durrer undertook experimental work in refining pig iron with oxygen at Gerlafingen (DX-246B, p. 4855; DX-258E, p. 5). To further his experimentation he secured permission for his former student, Dr. Heinrich Hellbruegge, to leave occupied Germany and assist him in his efforts (DX-245, pp. 5012-13; DX-246, pp. 4521-21A, 4524-25; DX-163, EX. B. p. 2.)

Evidence of the work performed at Gerlafingen was presented in the May 1948 issue of the Von Roll Plant News (DX-163 Ex. B) and the enlargements of the photographs therein (DX-50, 51, 52); a memorandum by Dr. Trenkler reporting his visit to Gerlafingen in May 1949 (DX-56E); the article written by Hellbruegge in the December 1950 issue of *Stahl* v. *Eisen* (DX-258E); and the report by Strassburger and McGarrity on Durrer's work at Gerlafingen (DX-168, Ex. B. pp. 103-06).

The May 1948 newspaper "Von Roll Plant News" (DX-163, Ex. B) contains an article by Durrer which the defendant urges in support of its contention that the patentees did not invent the subject matter of the patent in suit and that therefore the patent is invalid under Sec. 102. The de-

fendant does not urge, nor could it, that prior use abroad is, as prior *art*, a bar to [9] patentability under Sec. 102(b). Before a publication will be considered anticipatory under Section 102, it is necessary that:

> "... the description and drawings contain and exhibit a substantial representation of the patented improvement, in such full, clear, and exact terms as to enable any person skilled in the art or science to which it appertains, to make, construct, and practice the invention to the same practical extent as they would be enabled to do if the information was derived from a prior patent. *Mere vague and general representations will not support such a defense*, as the knowledge supposed to be derived from the publication must be sufficient to enable those skilled in the art or science to understand the nature and operation of the invention, and to carry it into practical use. Whatever may be the particular circumstances under which the publication takes place, the account published, to be of any effect to support such a defense, must be an account of a complete and operative invention capable of being put into practical operation." *Seymour* v. *Osborne*, 78 U.S. 516,555 (1870). (Emphasis supplied).

See also: *McCullough Tool Company et al.* v. *Well Surveys, Inc.*, 343 F.2d 381 (10th Cir. 1965); *cert. denied* 383 U.S. 933 (1966); *rehearing denied* 385 U.S. 995 (1966); *Dewey & Almy Chemical Co., et al.* v. *Mimex Co., Inc.*, 124 F.2d 986 (2d Cir. 1942).

The Von Roll Plant News of May 1948 reveals little in the way of anticipation of the Suess work. It merely, in very general terms, reveals the use of oxygen in the refining of pig iron: "In order to refine pig iron into steel, it is necessary to reduce its carbon content ... This reduction occurs by means of combustion with the aid of oxygen which oxidizes the carbon, a reaction occurring in every case where carbon is burned ... Oxygen is brought in contact with the liquid pig iron either in a combined form ... or in a free form [10] ... Free oxygen in the form of

air is blown *through* the molten pig iron . . . Smelting and refining with pure oxygen or with oxygen-enriched air will modify iron recovery decisively, and leading iron producing countries have already begun to tackle this problem with great energy . . . necessary preparations are in course in our Gerlafingen plant, and on the first day of spring, Dr. Heinrich Hellbruegge, or 'oxygen man' has conducted the first test, and thus pig iron was refined to steel with undiluted oxygen (oxygen-refining) for the first time in Switzerland . . ." (Emphasis added). This vague description of the work at Gerlafingen does not in any way contribute to an understanding of the basic oxygen method of producing steel. It, in fact, does little more than indicate that at Gerlafingen an attempt was made to use "undiluted oxygen" in the refining process. No indication is made as to whether the blow was made from the top, side or bottom, or where the jet was directed; or how the jet was controlled, but only that it was through the molten pig iron. Because of its failure to disclose the patented process, the Von Roll News Letter is not an anticipatory publication. *Seymour* v. *Osborne, supra; McCullough Tool Company* v. *Well Surveys, Inc., supra; Dewey & Almy Chemical Co.* v. *Ninex Co., Inc., supra.*

4. STRASSBURGER-MCGARRITY "REPORT ON INVESTIGATION OF EUROPEAN STEEL PLANTS (OCTOBER-NOVEMBER, 1949)." COPYRIGHT 1950, NATIONAL STEEL CORPORATION, PITTSBURGH, PENNSYLVANIA (DX-168, EX. B).

The Strassburger-McGarrity report is a summation of the [11] author's discussions with Durrer who amongst other things related information concerning the work at Linz (DX-168, Ex. B, pp. 96-106). The portion of this article which is of interest, commences on p. 103 and is sub-headed "Oxygen on the Basic Converter." Prior to this discussion the report summarizes a visit to Linz on October 24 and 25, 1949, as follows:

> "Our impressions of the steel plant of Voest at Linz, Austria, were very favorable, particularly after inspecting other plants in Europe. Voest had modern type blast furnaces using a high sinter burner with good blast furnace practice and a very low coke rate . . . The research program being carried on at the plant with the small converter all points to a large 40-60 ton basic converter installation with the use of oxygen either through the bottom mixed with the air or 98% oxygen jetted down on the bath. The plant management gave the impression of being agressive and on their toes on new developments." (DX-168, Ex. B. p. 15).

The report continues, pp. 103-104:

> The plant at Gerlafingen, ". . . has a 2½ ton experimental converter for oxygen trials. The oxygen is introduced through a water-cooled jet from above, jetting down on top of the bath . . . The steel quality produced has been good and the entire blast supplied to the converter was through the oxygen jet above the metal. High purity oxygen close to 98% purity is a distinct advantage in this process . . . it has stated that it is cheaper to produce the oxygen required for this process at 150 pounds pressure than to blow the very much larger quantity of air through a bottom-blown vessel at 30 pounds pressure . . ."

The report continues to explain that Dr. Durrer is one of a group of individuals working on this project, and that amongst others who were considering its ramifications was Dr. Suess at VOEST (p. 104). The report adds, pp. 104-106:

> "It was stated that Voest in collaboration with Dr. Durrer has made extensive experiments on a small converter using top blown oxygen and that Voest is now starting to build a new converter plant and oxygen plant for the operation of the converter with oxygen blown on top of the bath. This whole development of **[12]** oxygen on top of the converter bath has been brought about by the experience gained with the use of oxygen jets on an electric furnace without using the electrodes for melting the charge. In the oxygen

top blown converter, the scrap will be added during the blow in increments by special charging equipment.

"We want to point out that the development of the oxygen top blown converter is one of the most important and interesting developments found on our trip to Europe. As you will note there have been three plants where experimental work has been carried on in small convert (sic) for developing this process, namely, at Linz, Huckingen and at Dr. Durrer's plant at Gerlafinge. The oxygen top blown converter is being developed to produce a high grade open hearth steel in a basic converter with low nitrogen and oxygen contents in the metal and suitable for deep-drawn sheets . . .

"Our conference with Dr. Durrer was most interesting. He was the most informed person with whom we had contact in Europe and undoubtedly a man of vision and had lived up to his reputation of being the foremost man in metallurgy in Europe. He is working under handicapped conditions in Switzerland with high priced coke and iron ore and by his ingenuity has developed the electric oxygen process as a means of making iron and steel in a small plant . . . He is very enthusiastic about the use of oxygen and this is no doubt due to the large savings in electric power that has been made possible in his plants by the use of oxygen instead of using electrical power by itself for the melting of scrap and iron, as well as the improvement in steel quality by the use of oxygen on the basic Thomas converter."

While these findings are without question a tribute to Durrer's pioneering efforts in this field, there does not appear to be any conclusive indication attributing the process of the patent in suit to Durrer. At best there is an indication that as of October 1949 Durrer, along with others, was searching for a practical means for utilizing the theory of applying oxygen from above. This evidence adds credence to the conclusion reached earlier that the work of Durrer was essentially experimentation, and development of the process devised by **[13]** Schwarz.

However, even if one assumes that the Strassburger-McGarrity Report describes the invention, it cannot be con-

sidered prior art because of its publication after January 16, 1951, the date on which the instant patent application was originally filed.[6] The record reveals that on January 17, 1950, patent counsel for National Steel Company received a letter from Strassburger dated January 16 informing him that 3 copies of the report would be forwarded under separate cover (DX-168A). By letter dated January 27 (DX-168C) counsel acknowledged receipt of the reports and indicated a future intent to register the report for copyright, but at that time related a decision to delay application for copyright. Again on October 3, 1950, a decision was made to delay application for copyright "until the book has been more widely distributed" (DX-168E). Finally, on March 6, 1951, an application for copyright was filed (DX-168F). In the Certificate of Registration (DX-168G) it is stated "The affidavit states that the book was published on January 27, 1950, in the United States."

It is settled law, that a document is not considered a prior publication under Section 102 unless it was accessible to the public. *Application of Tenney*, 254 F.2d 619 (C.C.P.A. 1958); *Dow Chemical Co.* v. *Williams Bros. Well Treating Corporation*, 81 F.2d 495 (C.A. 10, 1936), *cert. denied* 298 U.S. 690 (1936); *Reeves* v. *Keystone Bridge Co., et al.*, 20 Fed. Cas. 466 (Fed. [14] Case No. 11,660) (C.C.E.D. Pa., 1872); United Chromium, Inc., v. General Motors Corporation, 11 F.Supp. 694 (D.C.D. Conn. 1935), *reversed on other grounds*, 85 F.2d 577 (C.A. 2, 1936).

Thus, the patent in suit is not anticipated under § 102(a) or under § 102(b).

B. Lack of Inventorship

It is provided in 35 U.S.C. § 102(f) that

> "A person shall be entitled to a patent unless—(f) he did not himself invent the subject matter sought to be patented . . ."

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[6] The certificate of registration in the Copyright Office states that the book was published on January 27, 1950.

The defendant contends that the patentees did not invent the process described in the specification of the patent in suit, but rather that it was invented by Drs. Durrer and Hellbruegge at the Von Roll Eisenwerke plant during the period from 1947 through 1949. Essentially the work of Drs. Durrer and Hellbruegge consisted of blowing oxygen from above onto the surface of a molten bath. However, in both the present *J & L* case [7] and the prior *McLouth* [15] case,[8] it was conceded that the work at Gerlagingen consisted essentially of following the teachings of Schwarz.

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[7] During the course of the proceedings in this Court, the following exchange took place between the Court and Mr. Blenko, counsel for the defendant (R. 4725-26):

> "THE COURT: Then how do you contend that the Durrer-Hellbruegge process differed if at all from the Suess patent?
> MR. BLENKO: I contend that the Durrer-Hellbruegge work contains everything of substance in the Suess patent, but does not contain the frivolous and totally erroneous requirement that there be avoidance of material agitation.
> THE COURT: And, if the Suess patent is in effect a repeat of the Schwarz and Miles patents and is in effect a repetition of the Durrer-Hellbruegge process, then the Durrer-Hellbruegge process is by the same token a repeat of Schwarz-Miles?
> MR. BLENKO: Yes."

[8] During the *McLouth* proceedings, a similar exchange occurred between the Court and Mr. Groner, counsel for the defendant (See p. 13,503 of Plaintiffs' Estoppel Exhibit J-40, the McLouth transcript):

> "MR. GRONER: . . . The patent in suit is limited to vertical blowing. Durrer had vertical blowing, Schwarz taught what could only lead to vertical blowing, and Miles specifically included in his teaching vertical blowing.
> "THE COURT: Well, then, you admit that Schwarz and Miles and Durrer and Hellbruegge all teach the same method.
> "MR. GRONER: There are minor detail differences, but so far as the basic method is concerned, they are alike as peas in a pod."

Based on this statement and other matters in the record, Judge Freeman stated: "It is admitted by defendant that the practice of Dr. Durrer and Dr. Hellbruegge at Gerlafingen was essentially indistinguishable from the teachings of the Schwarz patent." (257 F.Supp at 407).

In an article "The conversion of pig iron into steel in the converter by using pure oxygen" by Hellbruegge,[8] it was stated that ". . . in order to be able *to operate with pure oxygen, it becomes necessary to abandon the heretofore used method of blowing through the bath* and to blow the oxygen onto the bath. The blowing onto the bath *must not be done with too little pressure as otherwise there will only be a surface reaction. This means that too much oxygen is lost, the refining takes too long a time, and the iron content of the slag will be too high.*" (p. 5). The article continues at page 7, "The oxygen was blown onto the bath with a pressure of 6 to 8 atu. The *pressure of the oxygen jet must be sufficiently strong to cause the jet to penetrate* into the bath, especially at the beginning and toward the end of the melt. There was hardly any throwout, even when increased pressure, for instance, 10 to 12 atu was used **[16]** for blowing." (Emphasis added) in concluding the Article, Dr. Hellbruegge stated that, ". . . it is possible to refine pig iron of varying composition with pure oxygen . . . Refining with pure oxygen eliminates the heretofore encountered narrow analytical limitations for Thomas or Bessemer pig iron." (p. 14). While Dr. Hellbruegge testified in *McLouth* (PX-J-15 pp. 4895-96) that this article was not a complete disclosure of the many details of their work, it would appear that at best it is a superficial discussion of possibilities, and not substantial practice and is indicative of the art at that time. Furthermore, the article was published in December, 1950 almost a year after the Austrian patent application was filed by Suess, and just prior to the American Application.

After a thorough and detailed analysis of the work at Gerlafinge, the McLouth District Court concluded:

> "The marked improvement in the quality of the steel produced in regard to phosphorus removal in the June

[8] *Stahl and Eisen* article December 21, 1950, Vol. 70, No. 26 pp. 1208-1211 (DX-258E)

25th series of tests without even the use of an afterblow, and also the considerable inprovement in refractory life indicate strongly to this Court that the June 25th tests at Linz *represented a different and more successful process than had been practiced or disclosed by Dr. Durrer and Dr. Hellbruegee.* These tests, involving a relatively low impact pressure of the jet on the bath as opposed to the recommendation of Dr. Durrer and Dr. Hellbruegge, remedied what Dr. Trenkler had stated to be the two major defects of the Gerlafingen process, namely, excessive phosphorus content in the steel produced and insufficient refractory life." (257 F.Supp. at page 415). (Emphasis added).[10]

[17] This ultimate conclusion, once again illustrates that the work performed by Drs. Durrer and Hellbruegge did not contain any innovative processes but rather sought to find a means of employing the prior art successfully.

"The defense of prior use is one that an alleged infringer, although free to raise, has the burden of persuasion. This burden is a heavy one, having been described by this Court as necessitating evidence that 'must be so strong as to remove all reasonable doubt

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[10] To a large extent, the evidence on this point which was before the *McLouth* District Court, was introduced in these J & L cases. Dr. Durrer had testified that the Schwarz patent contained his ideas (PX-510, p. 5101). Dr. Trenkler indicated that an operative process did not exist at Gerlafingen in May 1949 (PX-508, p. 11911).

As late as July 28, 1952, Hellbruegge was still advocating the use of a deeply penetrating jet. In a letter to Dr. Kafka, Hellbruegge stated that he believed the Linz work to involve deep blowing similar to Schwarz (DX-255E, p. 4). This belief was incorporated by Hellbruegge in his testimony (DX-246, p. 4667).

In regards to his visit to Gerlafingen in June, 1949, Dr. Trenkler testified ". . . while at Gerlafingen, I received from both gentlemen, but particularly from Dr. Hellbruegge, the communication that it was necessary in conducting oxygen top blowing to blow deeply." (PX-508, p. 11950).

Hellbruegge testified that in all his experimental work an afterblow was necessary in order to provide adequate phosphorus removal (PX-511, pp. 4915-16).

thereof.' . . ." *Jones Knitting Corporation et al.* v. *Morgan et al.*, 361 F.2d 451, 455 (3 Cir. 1966)

From the discussion above, I conclude that the defendant has failed to show that a valid defense can be raised under Section 102(f).

C. Obviousness

It is provided in 35 U.S.C. § 103 that:

> "A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made."

[18] This provision was more thoroughly analyzed in *Graham* v. *John Deere Co.*, 383 U.S. 1, 17-18 (1966):

> "Under § 103, the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background, the obviousness or nonobviousness of the subject matter is determined. Such secondary considerations as commercial success, long felt but unsolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented."

The prior art must be determined as of the time the earliest foreign patent application was filed. 35 U.S.C. § 104, 119. The patentees filed their Austrian application on January 31, 1950, however, the record discloses that a prior Swiss application was filed on January 27, 1950.[11]

[11] The defendant argues that the failure of the patentees to cite the prior Swiss application as the earliest foreign application date

As Judge Freeman found, I too find that the essential issue to be considered under Sec. 103 is whether or not the subject matter of the patent in suit would be obvious to one skilled in the art at the time the invention was made. As the Court stated in *Graham, supra,* the question of obviousness is to be determined in view of the prior art, and the level of skill of those in the pertinent art. To these considerations one also includes an examination of the claims in the light of prior art, commercial success, unsolved needs, and failures of others. As the Court of Appeals for the Third Circuit states in *Philips Elect. & P. Indus. Corp.* v. *Thermal & Elec. Indus.,* [19] 450 F.2d 1165 (3d Cir. 1971), "It was, therefore, necessary for the trial court to ascertain the scope and content of the prior art, the differences between the prior art and the claims at issue, and the level of ordinary skill in the art." 450 F.2d at page 1172,

That is,

> ". . . unless more ingenuity and skill . . . were required . . . than were possessed by an ordinary mechanic acquainted with the business, there was an absence of that degree of skill and ingenuity which constitute essential elements of every invention." *Hotchkiss* v. *Greenwood,* 52 U.S. 248, 267 (1850).

1. Scope and Content of Prior Art.[11.1]

Prior art is " 'The existing state of knowledge in a particular art at the time an invention is made. It includes the issued patents . . . , publications, and all other knowl-

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(pursuant to 35 U.S.C. § 119) perpetrated a fraud on the Patent Office. This issue is discussed further under the question of fraud, *infra.*

[11.1] A more highly detailed explanation of the prior art and the instant patent has been presented in the Compendium. In the interest of brevity, those relevant references in the Compendium are adopted and incorporated here, by reference.

edge deemed to be common thereto such as trade skills, trade practices, and the like?" *Trio Processing Corporation* v. *L. Goldstein's Sons, Inc., supra* at p. 69 n. 3.

The prior art Schwarz and Miles patents have already been discussed. In summary form, it may be stated that they teach the necessity of blowing deeply, and non vertically into the bath so that the bath itself is agitated by the physical force of the oxygen stream. Furthermore, I am in substantial accord with Judge Freeman's conclusion that:

> ". . . the Schwarz German patent and the Miles Belgian patent taught and claimed processes of steelmaking involving blowing oxygen into a bath of molten pig iron from above. Schwarz taught blowing deeply into the bath in the manner of a solid body . . . and, although Miles did not expressly teach 'deep' penetration, it is conceded by the parties that Miles' teachings involved a deep penetration of the bath by the jet . . . With regard to the blowing, the angle of the jet in the Schwarz patent is unspecific and the Miles patent recommends blowing at an angle of between 30 and 75 degrees . . . The Miles patent teaches that the action of the jet itself agitates [20] and circulates the bath . . . but the Schwarz patent *contains no such teaching.* Both the Schwarz and Miles patents contain reference to a *limited center of chemical reactions in the bath* caused by contact of the jet with the bath surface . . . Additionally, both the Schwarz and Miles patents teach that the danger of excessive refractory wear is avoided in their methods of steelmaking because the *chemical reactions take place at the center of the bath,* away from the refractory lining . . . The parties agree that the gist of the teachings of both the Schwarz and Miles patents is the necessity of penetrating deep into the bath by the oxygen jet." (257 F.Supp. at pages 397-98). (Emphasis added).

Furthermore, we are reminded of the testimony of Dr. Durrer, that the prior patent failed to lead to practical commercial steelmaking processes (PX-510, p. 5085).

Both during the trial and at final argument, counsel for the defendant relying on DX-212 and DX-213 advanced the contention that indeed the depth of the Miles penetration is slight compared with that of the patent in suit. This position is without foundation. If one examines the absolute depths of penetration of Miles and Suess and the defendant's operations at Aliquippa and Cleveland as indicated on DX-212 and DX-213, one might initially assume that the Miles penetration is slight as compared with that in the Suess process. These exhibits, however, exclude a critical consideration. Depth of penetration is a relative measure and one can only say that penetration is slight or deep in relation to the depth of the bath being [21] penetrated.[12] Furthermore, in view of the fact that both the Schwarz and Miles patents were before the Patent Office for consideration, their weight as prior art is greatly diminished. *Hartford National Bank & Trust Co. et al.*, v. *E. F. Drew & Co., Inc.*, 237 F.2d 594 (3d Cir. 1956).

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[12] Table based on DX-212 (R. 4481-82) and page 37 of Plaintiffs' Reply Brief:

Operation	Bath Depth	Penetration	% Penetration
Miles	16 inches	6.9 inches	43%
Aliquippa Single Hole Nozzle	38 inches	5.0 inches	13%
Aliquippa Two Hole Nozzle 1	38 inches	4.0 inches	10.5%
Cleveland M16C Nozzle	68 inches	6.0 inches	9%
		8.0 inches	12%
Cleveland M18C Nozzle	78 inches	6.5 inches	9.5%
		9.0 inches	13%

Table based on DX-213 (R. 4483-87) and page 36 of Plaintiffs' Reply Brief

Operation	Bath Depth	Penetration	% Penetration
Miles	16 inches	6.9 inches	43%
The patentees following Miles Suess et al. Patent	19.6 inches	8.2 inches 1	43%
	39.4 inches	12.5-13.0 inches	33%

2. Difference Between the Prior Art and the Claims Must Be Ascertained.

To a large extent, these differences have been exhaustively reviewed under collateral estoppel. For this reason, they will be presented in summary form here.

The patent in suit teaches discharging a stream of pure or nearly pure oxygen substantially vertically, downwardly through the slag layer onto and below the surface of the bath at the central portion thereof. Schwarz on the other hand does not reveal a controlled, central, vertical blowing. The [22] same is true of the Miles process.

The patent in suit further teaches that the oxygen is blown to such an extent to avoid physical agitation of the bath by the oxygen stream.[13] In contradistinction, Schwarz taught that the oxygen stream must penetrate the bath like a solid body (DX-5A, p. 2). The results of Schwarz's practice led to inadequate phosphorus removal and rapid destruction of the refractories (R. 529, 839-840). Miles teaches that the jet itself serves to circulate and agitate the bath (DX-10A, p. 10).

The Suess process further teaches that the most significant oxidation reaction occurs in a localized reaction zone spaced a substantial distance from the refractories, thereby preserving the vessel. Schwarz on the other hand teaches deep penetration of the jet so that reaction occurs wherever oxygen and metal are in contact. Thus, one may assume that reaction occurs throughout the bath with resultant refractory damage (R. 725,731). No localized reaction zone is taught by Miles, and with its deep penetration, oxidation occurs throughout the bath.

The patent in suit also teaches that circulation in the bath is chemically induced and not disturbed by any physical result of the force of the impinging oxygen stream.

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[13] See discussion on avoidance of material agitation, *supra*.

This is distinctly different from Schwarz who achieved a degree of physically induced circulation from the force of the oxygen stream itself. Miles likewise teaches that the jet itself, [23] physically causes circulation in the bath (DX-10A, p. 18).

In summary fashion it may be stated that Schwarz and Miles taught the necessity of blowing oxygen deeply into the bath so that the physical force of the jet itself agitates and circulates the bath. The opposite is true of the patent in suit in which the physical force was minimized as much as possible. That is, the Suess process reduces impact pressure to such an extent to avoid physical agitation of the bath by the oxygen stream. Furthermore, by so restricting the reaction zone to a localized area, damage to the refractories was substantially prevented.

3. Level of Ordinary Skill in the Art.

The level of skill in the art at the time the invention was made, may be gauged from the "amazement" of Dr. Chipman (R. 576); Mr. Prince' comment that he didn't think it was possible (R. 3208-11); Dr. Elliott's astonishment (PX-504, p. 6324); and Dr. Durrer's reaction (DX-251E).

Thus, it appears that the patent in suit far surpassed the level of skill in the art, and was thus non-obvious to those skilled in the art.

Further evidence of the lack of obviousness is shown by the fact that numerous persons skilled in the art had unsuccessfully attemped to produce satisfactory steel by blowing onto the bath from above. As was stated at the final argument by counsel for the plaintiffs (R. 225-26):

[24] "Next, we have the Durrer-Hellbruegge history which shows that the invention in issue is not obvious to those skilled in the art. This history of failure to solve the problem of using high purity oxygen in the blowing of steel, although preaching that it should be solved, extends over a period of two decades. Dr. Dur-

rer recognized after the Linde-Fraenkl invention that if oxygen was available and he tried it out in small tests, he got nowhere. He tried again in the 30's. There were small experiments in the school. And then he tried it out in a two-ton vessel at Gerlafingen in 1948. And that wasn't successful. He tried again in 1949, and the evidence here shows that that was not successful.

"So you have not only 10 to 14 highly-skilled men in the art trying to solve the problem as Durrer testified and who as Dr. Durrer testified failed, we have Dr. Durrer and Dr. Hellbruegge also failing." [14]

The very mundane, and yet very real question arises that if the process described in the patent in question was obvious to those skilled in the art of steelmaking, why wasn't satisfactory steel produced pursuant to the teachings of Schwarz, Miles and Durrer-Hellbruegge prior to the time of the patent in suit? Why were know-how agreements entered into between the defendant here and the plaintiffs, or between McLouth and the plaintiffs, if in fact the process was obvious to those skilled in the art?

The use of oxygen itself was not a novel concept. It had been suggested as early as 1856 by Bessemer (PX-510, p. 5107). The practical implementation of the concept, however, did not occur until almost a century later. The fact that there was a technological block in the practical implementation of a concept which those skilled in the art had failed to eliminate is strongly supportive of the concept of lack of obviousness, *United States* v. *Adams, supra; Trio Processing Corporation* v. *L. Goldstein's Sons, Inc., supra; National Latex Products* [25] *Company* v. *Sun Rubber Company,* 274 F.2d 224, 240 (C.A. 6, 1959), although commercial quantities of oxygen were available prior to the extensive period of experimentation.

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[14] From PX-308 it would appear that over 30 men were actively engaged in the application of oxygen to metallurgy.

Despite the Hellbruegge article previously discussed (DX-258E, p. 14), the testimony of Dr. Trenkler (PX-508, pp. 11901-04, 11929) relates that at the Gerlafingen works, Drs. Durrer and Hellbruegge had failed to remedy the difficulties of preserving the refractory lining. This was further confirmed by the Rinesch affidavit (PX-2A, pp. 79-80, 96-97), and the Hauttmann affidavit (PX-2A, pp. 88-92).

4. Secondary Considerations

While secondary considerations alone will not create patentability, *Hadco Products, Inc.* v. *Walter Kidde & Co.*, 462 F.2d 1265 (3d Cir. 1972), under *Graham* v. *Deare, supra*, certain secondary considerations may also be reviewed in arriving at a determination of obviousness. See also: *Jones Knitting Corp.* v. *Morgan, supra*, 285 F.2d 501 (C.A. 2, 1960).

Plaintiffs' 9xhibit 81A is a statistical compilation of steel production in the United States, based on figures contained in the Department of Interior's *Minerals Yearbook*, and shows that in 1955 total steel production in the United States was about 117 million short tons of which 105 million short tons were produced in open hearths while only 0.3 million short tons were produced in basic oxygen furnaces; that in 1965 total steel production in the United States was about 131 million short tons of which 94 million short tons were **[26]** produced in open hearth while 23 million short tons were produced in basic oxygen furnaces; that by 1969 total steel production in the United States was about 141 million short tons of which about 61 million short tons were produced in open hearths while 60 million short tons were produced in basic oxygen furnaces, and that in 1970 of a total production of steel in the United States of about 132 million short ton, 48 million short tons were produced in open hearths while 63 million short

tons were produced in basic oxygen furnaces.[18] Thus the rapid change in the method of steel production in the United States during a fifteen year period during which time production via the basic oxygen process surpassed production in the open hearth furnaces is clearly "persuasive" of the recognition of the importance of the invention.

Further lack of obviousness arises from the *skepticism* of McLouth when it constructed its basic oxygen furnace in Trenton, Michigan. Ivor Bryn an officer and Director of McLouth testified (PX-470, p. 1296) that "We weren't sure of the advantages when we made the decision to build it. That's the reason we were skeptical and put the duplex in." He then continued (PX-470, pp. 1297-1299):

> "Q. And I gathered from your statement that you were not sure at the time as to whether or not you would be able to get a product comparable with the product of the open hearth process?
> "A. That's right. That's the reason we spent the dough to make it possible to duplex or otherwise we wouldn't have thrown that dough out the window.
>
> [27] "Q. So far as McLouth's business is concerned at that time, I would take it that the steel made by the Bessemer process just wouldn't have been adequate to enable you to continue to supply your customers to whom you were selling at the time, right?
>
> "A. Bessemer steel as such, you are saying?
>
> "Q. Yes.
>
> "A. O.K. That's right, but that's another reason we put this duplex thing in. We thought Bessemer or the oxygen process would permit us to go to duplex, whereby we would be able to serve them with a product that in our opinion was satisfactory.
>
> "Q. Now, what particular feature of the Bessemer-made steel would have made it inapplicable or inadequate for your purposes, Mr. Bryn?

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[18] The 1970 figures are derived from data compiled by the American Iron and Steel Institute.

"A. High nitrogens.

"Q. And were you afraid that you might possibly run into that same condition so far as the oxygen process is concerned?

"A. We weren't afraid of that. We didn't know what we were getting into. We did not know what our sulphur problems were going to be, phos, or any of those things."

• • •

"Q. So as a consequence, as I understand it, you put in the duplexing equipment, at the outset?

"A. That's right.

"Q. And you later found that by this process it was not necessary to duplex?

"A. That's right.

"Q. And that you could get a steel of adequate quality without duplexing?

"A. Right.

"Q. Now, were you at that time aiming for a product of quality equal to or better than the quality of the open hearth product?

"A. At that time our aim was to be as good.

"Q. As good as open hearth?

[28] "A. That's right."

In *Loom Company* v. *Higgins*, 105 U.S. 580, 591-92 (1881) the Supreme Court stated:

> "It may be laid down as a general rule, though perhaps not an invariable one, that if a new combination and arrangement of known elements produce a new and beneficial result, never attained before, it is evidence of invention. It was certainly a new and useful result to make a loom produce fifty yards a day when it never before had produced more than forty; and we think that the combination of elements by which this was effected, even if those elements were separate-

ly known before, was invention sufficient to form the basis of a patent."

The Court of Appeals for the Third Circuit in *Corning Glass Works* v. *Anchor Hocking Glass Corporation,* 374 F.2d 473, 476 (C.A. 3, 1967), *cert denied,* 388 U.S. 826 (1967) stated that:

> "The District Court held that the Corning patent is '. . . a basic and pioneering advance in glass and ceramic technology.' 253 F.Supp. 461 at 465. We believe that Dr. Stookey's discovery is, in every sense of the word, a 'pioneer' ---' . . . a patent covering a function never before performed, a wholly novel device, or one of such novelty and importance as to mark a distinct step in the progress of the art, as distinguished from a mere improvement or perfection of what had gone before.' *Westinghouse* v. *Boyden Power Brake Co.,* 170 U.S. 537 at 561, 562 . . . (1898). *Where the court is confronted with such a pioneer patent liberality becomes the keynote of construction* requiring the court to give the patentee a wide breadth of protection in construing the patent claims and specifications . . ." (Emphasis supplied).

The defense of obviousness is further weakened by statements of men, highly skilled in the art and clearly recognized for their expertise, which are cited above and merely repeated for emphasis.

Dr. Chipman, former head of the Department of Metallurgy at M.I.T. testified (R. 576-77) that when he learned of the work of the patentees; he "was amazed" and "wondered if it could [29] really work this way with vertical blowing. . . . It was not my business to develop an oxygen process, but if it had been, I think at the time I would have thought it necessary to go to deep blowing at an angle. This would have been my approach at that time before I heard a description of the LD process."

Mr. Prince, an employee of Kaiser Engineers whose occupation is as a steel plant technician specializing in LD operations and practice testified (R. 3208-11):

> "Q. What was your reaction when you first heard about the LD process?
>
> "A. It seemed to me at that time rather an extravagant use of oxygen. I didn't think it was possible to melt scrap and refine pig iron using oxygen alone . . .
>
> I couldn't understand how by using oxygen alone you could make steel. I was familiar with the use of oxygen as part of the steelmaking process. . . . But a process which involved only a stream of oxygen onto a charge of molten iron and scrap, I couldn't understand at that time . . .
>
> "Q. To sum up on that point, would it be fair to say that on the state of your knowledge at that time, you just didn't believe it possible that this process would work?
>
> "A. No, I didn't believe it possible, Mr. Webb, at that time . . .
>
> It was something so new and so outside of my experience that it was very difficult to understand how they could complete a heat of steel using oxygen along in what amounts to a crucible . . .
>
> . . . to do the whole thing in one shot with a big stream of oxygen seemed at that time to me a little bit too much."

Dr. Elliott, a Professor of Metallurgy at M.I.T. testified in *McLouth* (PX-504, p. 6324) that when he first heard of the Suess process he was ". . . astonished to find that the use of oxygen could be accomplished successfully in such a simple **[30]** manner."

In *Cimiotti Unhairing Co.* v. *Am. Fu Ref. Co.*, 198 U.S. 399, 409 (1905) the Court held that the inventor ". . . has taken the step which marks the difference between a successful operating machine and one which stops short of

that point and that advance entitles him to the protection of a patent." Judge Coxe speaking for the Second Circuit in *Cimiotti Unhairing Co. et al.* v. *American Unhairing Mach. Co.*, 115 Fed. 498 (C.A. 2, 1902), which was cited with approval in the Supreme Court's opinion, stated, "Covert came nearer than any one else to a successful machine. He had but one more step to take and here he became bewildered and went astray."

Few, if any, inventions arise spontaneously from the minds of their inventors. Of necessity there must be some prior art upon which the novelty of the newly discovered matter rests. Thus it is that when one successfully creates that "advance" or "step" which differentiates the invention from the prior art, he becomes entitled to the protection provided in our Patent Law.

In view of the success of the patentees whereas all previous work had met with failure my belief that the present invention lacked obviousness is reinforced.

D. Double Patenting.

The defendant, relying on *Miller* v. *Eagle Manufacturing Co.*, 151 U.S. 186, 197 (1894), asserts that the patent in question is invalid because ". . . under the well-settled rule . . . two valid patents for the same invention cannot be granted either to the same or to a different party." And in support of its claim of double patenting, the defendant cites Cuscoleca patent number 2,741,555 (DX-22), and alleges that the claims of the Cuscoleca [31] patent are addressed to and cover the same invention as the claims of the Suess patent, and that the two patents are owned by a common entity. The latter patent issued on April 10, 1956, about 15 months prior to the Suess patent.

The Cuscoleca patent ". . . relates to a process for refining pig iron in a converter or other suitable vessel, in which oxygen or other oxidizing gases or oxygen-contain-

ing gas mixtures are blown against the bath surface from above and the heat quantity required for the process is produced by the reaction of the oxygen with the impurities in the molten pig iron bath." (Col. 1, lines 15-21). The specification continues, "It is accordingly a primary purpose and object of this invention to provide a process for the refining of primarily hot metal charge, that is, predominantly molten pig iron, with high purity gaseous oxygen in which controlled refining at substantially theoretical oxygen efficiency is accomplished." (Col. 2, lines 22-27). In its particulars, the Cuscoleca patent very closely resembles and it might even be said to parallel the Suess et al. patent. Some specific illustrations of these similarities will clearly demonstrate these parallelisms: using a surface blow of high purity oxygen thereby obtaining exceptionally high refractory life (Col. 2, lines 28-31); producing a controlled reaction thereby avoiding over-oxidation (Col. 2, lines 32-36); and providing a high purity oxygen refining process which is applicable to pig iron of varying chemical compositions resulting in the production of high quality steel (Col. 2, lines 37-53).

The Cuscoleca patent further teaches that there is an [32] approximate vertical impingement of the oxygen stream on the central portion of the bath surface (Col. 5, lines 37 to 45); that one should use high purity oxygen, i.e., at least 97 percent oxygen, but with at least 98 percent oxygen preferred (Col. 6, lines 38-45; Col. 11, lines 64-65); that the slag layer is initially displaced or penetrated by the oxygen jet itself (Col. 3, lines 37-40); that the pressure of the jet is such that deep penetration of the bath is avoided (Col. 3, lines 47-54); that the blast nozzle be spaced between 150 to 2000 mm. from the quiet bath surface, and preferably above 250 mm. through the operating ranges of nozzle pressures from 3 to 20 atmospheres; that utilizing the process results in confining the zone of direct oxygen reaction to the central portion of the bath (Col. 5, lines 69-

71); that the process produces a bath circulation toward and away from the centralized reaction zone (Col. 6, lines 71-75); that over-oxidation of the steel is avoided (Col. 6, line 75 to Col. 7, line 18); that the process promotes an early fluid slag which results in the reduction of phosphorus and sulfur (Col. 6, lines 49-66); and that by confining the zone of direct oxygen reaction to the central portion of the bath, the refractory lining is afforded substantial protection (Col. 5, line 69 to Col. 6, line 6). Thus, it would appear that there is considerable identity between the specifications of the Cuscoleca patent and the patent in suit. However, it must be borne in mind that the Cuscoleca patent was cited in the file of the Suess et al. patent, and that therefore, the examiner did not find Cuscoleca anticipatory.

[33] Counsel for the defendant argues that although the original Suess application and the continuation-in-part application were filed prior to the application of Cuscoleca, the fact that the Cuscoleca patent issued on April 10, 1956, several days prior to the issuance of the Suess et al. patent, makes it prior art. I cannot agree with the contention for it is the filing date and not the issuance date which controls the issue of priority.

> "An application for patent for an inventoin disclosed in the manner provided by the first paragraph of section 112 of this title in an application previously filed in the United States by the same inventor shall have the same effect, as to such invention, as though filed on the date of the prior application, if filed before the patenting or abandonment of or termination of proceedings on the first application or on an application similarly entitled to the benefit of the filing date of the first application and if it contains or is amended to contain a specific reference to the earlier filed application." 35 U.S.C. § 120.

In essence, where as here the applicants by specific reference term the application which eventuated into the

patent in suit, to be a "continuation-in-part" of the application filed, and where there has been no abandonment, the applicants are entitled to the benefit of the earlier filing date. *Stricker Indus. Supply Co.* v. *Blaw-Knox Co.*, 405 F. 2d 90, C.A. 3, 1968.

Thus, the immediate question for our consideration is whether or not an abandonment of the original application occurred prior to the filing of the continuation-in-part application. As previously stated, the continuation-in-part application was filed while claims 14 and 15 of the original application were still pending before the Patent Office. In addition, considerable analyses of the original application and the continuation-in-part application have been presented which **[34]** demonstrate that the same fundamental concept of blowing vertically from above, onto and below the central surface of the bath under such controlled conditions of oxygen pressure and lance height so as to produce a localized reaction zone spaced away from the refractory walls and creating high quality steel with minimal refractory damage, permeates both the original and the continuation-in-part application. Thus, there was no abandonment of the inventive concept and the patentees are therefore entitled to the earlier filing date of their original application. *Stricker Indus. supra; Application of Ornitz*, 376 F. 2d 330, C. A. 3 1967.

As was stated in *Acme Highway Products Corp.* v. *D. S. Brown Company*, 431 F. 2d 1074, 1078 (C.A. 6, 1970), *cert. denied* 401 U.S. 956 (1971).

> "It is well established that to come within the purview of section 120, a later application must (a) disclose an invention which had previously been disclosed in the manner provided in 35 U.S.C. § 112 in an earlier application; (b) be by the same inventory; (c) be filed before the abandonment of the prior application; (d) expressly refer to the prior application.

From all that has been presented before me, it is clear that the patentees fulfilled these requirements and come within the purview of § 120.

The defense of double patenting is to prevent an inventor from extending the life of his claims beyond the allowable seventeen year period, by filing additional applications claiming the same invention. *Van Heusen Products, Inc.* v. *Earl & Wilson,* 300 Fed. 922 (S.D.N.Y., 1924).

In order to validly invoke the defense of double patenting **[35]** the claims of the patents in question must claim substantially identical subject matter. *Miller* v. *Eagle Manufacturing Company, supra; Helen Russell Pierce* v. *Allen B. DuMont Laboratories, Inc.,* 297 F. 2d 323 (C. A. 3, 1961); *Application of Wilhelm E. Walles,* 366 F. 2d 786 (C.C. Pa., 1966).

It is further required that in order to establish double patenting, it must appear that the two patents were issued to the same applicants. *Van Heusen Products, Inc.* v. *Earl & Wilson, supra; The University of Illinois Foundation* v. *Block Drug Co.,* 133 F. Supp. 580 (E. D. Ill., 1955); affirmed 241 F. 2d 6 (C. A. 7, 1957); *cert. denied* 354 U. S. 922 (1957).

The primary contention under the defense of double patenting is that the claim of the Suess and Cuscoleca patent are addressed to the same invention.

The Cuscoleca patent contains six (6) claims, whereas Suess contains two (2) claims.

The two claims of the Suess patent are drawn in broad inclusive language of " . . . discharging a stream of oxygen vertically downwardly through the slag layer onto and below the surface of the bath at the central portion thereof, to an extent to avoid material agitation of the bath . . . resulting in reaction of the oxygen with a portion of the iron and with oxidizable impurities of the bath in a localized reaction zone . . . resulting in refining

of the iron and gas evolution and . . . producing a circulatory movement in the molten metal . . ." Claim 2 specifies blowing with oxygen pressures of between 5 and 25 atmospheres above normal atmospheric pressure.

Contrast these claims with the claims of the Cuscoleca [36] patent the first of which claims "A process for refining molten ferrous metal by surface blowing with gaseous oxygen . . . substantially vertically downwardly onto the surface of said molten metal, said blast nozzle being spaced between 150 millimeters and about 2000 millimeters above the surface of the molten metal, and controlling the impingement of the oxygen jet on the surface of said molten metal such that the impact pressure of the blast heat on a reference surface spaced from the blast nozzle a distance equal to the distance of the molten metal surface from the blast nozzle is maintained below about 0.75 kg./sq.cm., and above about 0.02 kg./sq.cm., while supplying the oxygen at a rate sufficient to complete the refining in about 12 to 30 minutes." The second through fifth claims provide for blowing according to claim 1 but with variations in the impact pressure, and amount of solid ferrous metal scrap. The sixth and final claim includes the same control step except that it specifies that the "average impact pressure of the blast jet in the impingement area . . ." is maintained ". . . below about 0.75 kg./sq.cm. and at least about 0.1kg./sq.cm."

The Suess claims clearly do not specify the more limited operating parameters contained in Cuscoleca. In a much more limited fashion, Cuscoleca attempts to establish a closely controlled relationship betweem oxygen flow time, oxygen flow rate and impact pressure. Clearly, the more general Suess process does not conttain such highly specific limitations.

Perhaps the degree of specific refinement of Cuscoleca over Suess is best summarized by plaintiffs' final argument in which counsel stated:

[37] "If you practice Cuscoleca, I think you probably would be practicing Suess, but the reverse is not true. This is the situation which you have when you have a basic patent and an improvement patent follows, a genuine basic patent; and an improvement patent may come along also. And if you are practicing some of those improvements, why, you probably would practice the basic invention without practicing the improvements. (FA, p. 197) [16]

That is, practicing the more general patent would include the practice of the more limited, specific patent, but, the reverse is not necessarily true.

Furthermore, a claim which is the same as, or for the same or substantially the same the subject matter as, a claim of an issued patent may not be made in any application unless such a claim is made prior to one year from the date on which the patent was granted." 35 U.S.C. § 135(b) Where patent applications are pending at the same time, disclosures of one could not be prior art as to the other *Application of Baird,* 348 F. 2d 974, (C.A. 3, 1965). Thus, at best one could consider the Cuscoleca application a "co-pending" application.

The defendant further alleges that the Cuscoleca and Suess patents are owned by a common entity.

At the time they made their patent application, Suess, Hauttmann, Trenkler and Rinesch were employees of VOEST; Cuscoleca, Grohs, Rosner and Kuhnelt were employees of Osterreichisch-Alpine Montangesellschaft (OAMG). Although VOEST and OAMG were ostensibly owned by different entities, it has been shown that at all relevant times these were a part of the nationalized Austrian steel industry (DX-230, pp. 15-16).[17]

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[16] Transcript of record of final argument will be cited as "FA" (final argument).

[17] In his deposition (DX-230), Dr. Michaelis states that VOEST and OAMG were a part of the nationalized Austrian steel industry,

[38] At the time the original patent application was filed in the United States the VOEST group employed Attorneys Mock and Blum to prosecute their application, and the OAMG group retained Messrs. Singer, Sterm and Carlberg to prosecute their application. Subsequently, both VOEST and OAMG substituted Messrs. Campbell, Brumbaugh, Free and Graves which firm later became Brumbaugh, Free, Graves and Donahue to prosecute their applications in the United States. The fact that the ultimate prosecution of both applications fell upon the same firm of patent attorneys, without proof of sinister motives, demonstrates nothing more than a tribute to their competence in his field.

Because the defendant has failed to sustain its burden, it has failed to prove its defense of double patenting.

[39] *E. The Specification comports with Section 112.*

It is provided in Section 112 of Title 35, U.S.C., that:

> "The specification shall contain a written description of the invention and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention . . ."

Thus as to the adequacy of the specification, the test to be applied is whether or not one skilled in the art of steelmaking could practice the invention from the disclosures contained in the patent.

Justice Strong, writing for the Supreme Court in *Mowry* v. *Whitney*, 14 Wall. (81 U.S.) 620, 644 (1872) stated:

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but does not comment on the actual ownership of the two companies. Nothing was presented in the record here to conclusively demonstrate ownership.

> "The specification, then, is to be addressed to those skilled in the art, and is to be comprehensible by them. It may be sufficient, though the unskilled may not be able to gather from it how to use the invention. And it is evident that the definiteness of a specification must vary with the nature of its subject. Addressed as it is to those skilled in the art, it may leave something to their skill in applying the invention, but it should not mislead them."

Section 112 was thoroughly construed by the Court of Appeals for this Circuit in *Jones Knitting Corporation* v. *Morgan, supra.*, at pages 453-454 (CA3 1966):

> "Regardless of the fact that the term 'heat-insulating' may be one of degree, there is abundant evidence on this record taken as a whole that when one skilled in the art reads the Morgan Patent, he would be capable of producing the patented fabric and of determining the limits of the patent. As we interpret the statutory standard, this is all the inventor need show. 35 U.S.C.A. § 112.
>
> As succinctly stated by the Second Circuit in Georgia-Pacific Corporation v. United States Plywood Corporation, 258 F.2d 123 (2 Cir. 1958), [40] cert. den. 358 U.S. 884 . . . the requirement of 35 U.S.C.A. § 112 serves two primary purposes:
>
> '. . . those skilled in the art must be able to understand and apply the teachings of the invention and enterprise and experimentation must not be discouraged by the creation of an area of uncertainty as to the scope of the invention. On the other hand, the policy of the patent statute contemplates granting protection to valid inventions, and this policy would be defeated if protection were to be accorded only to those patents which were capable of precise definition. The judicial function requires a balancing of these competing considerations in the individual case.' (258 F.2d at 136)."

Georgia-Pacific v. U.S. Plywood Co., 258 F.2d 124 (C.A.2 1958), cert. den. 358 U.S. 884, 1958 in performing this balancing, teaches that:

> "'. . . patentable inventions cannot always be described in terms of exact measurements, symbols and formulae, and the applicant necessarily must use the meager tools provided by language, tools which admittedly lack exactitude and precision. If the claims, read in the light of the specifications, reasonably apprise those skilled in the art both of the utilization and scope of the invention, and if the language is as precise as the subject matter permits, the court can demand no more.'" (258 F.2d at 136) . . .

In the present case, a "know-how" agreement was entered into between Kaiser and J & L on August 8, 1956. Though the agreement was never introduced into evidence, its essence was to provide construction and "know-how." (PX-472 pp. 1188-89, 1198-99).

[41] In view of the facts that the teachings of the Schwarz and Miles patents were freely available in this country, and that J & L retains, and has for many years employed men of the highest skill in steelmaking, thus qualifying as a company highly skilled in that art, one wonders why J & L had to come to Kaiser for "know-how" if Kaiser had nothing new to sell. When presented with this question, counsel for J & L answered that Kaiser was retained to construct a new plant. The evidence, however, is much broader and shows emphatically that J & L sought basic oxygen application know-how at its Aliquippa plant, received instruction and written material, and sent its representatives to Linz, Austria, to learn first-hand how the Austrians applied the process.

> "Section 112 requires that the invention and the manner and process of using it must be described in full, clear, concise, and exact terms in order to enable a person skilled in the art to make and use the same. But these words must be reasonably interpreted and considered in the light of the evidence in the case and the nature of the invention. If the disclosure from the specifications and drawings is sufficient to enable a person of ordinary skill in the par-

> ticular art to make and use the invention, that is sufficient." *Reeves* v. *U.S. Lamination Corp.*, 282 F.Supp. 118, 128 (E.D.N.Y. 1966), aff. 417 F.2d 869 (C.A.2 1969).

The disclosure need not convince one skilled in the art that the assertions are correct. *In re Robins*, 429 F.2d 452 (C.C.P.A. 1970). But, the statute merely requires that the disclosure be such as to enable one skilled in the art to practice the invention. *Application of Naquin*, 398 F.2d 863 (C.C.P.A. 1968); *Hadco Products, Inc.* v. *Lighting Corp. of America, Inc.*, 312 F.Supp. 1173 (E.D.Pa. 1970); reversed on **[42]** other grounds, 462 F.2d 1265 (C.A.3 1972) cert. denied, 409 U.S. 1023 (1972); *Carter-Wallace, Inc.* v. *Riverton Laboratories, Inc.*, 304 F.Supp. 357 (S.D. N.Y. 1969).

Since the specification is directed to those skilled in the art, it is not necessary that details which would be obvious to a person so skilled be revealed. *Application of Myers*, 410 F.2d 420 (C.C.P.A. 1969). Nor, need it be a "production specification." *Trio Processing Corporation* v. *L. Goldstein's Sons, Inc., supra.* The question then is whether one skilled in the art could derive the final result from following the process. *Application of Grier*, 342 F.2d 120 (C.C.P.A. 1965). Thus, it is necessary that the *specification* make a meaningful disclosure to one skilled in the art which would enable him to practice the invention without the necessity of extensive experimentation. *Application of Diedrich*, 318 F.2d 946 (C.C.P.A. 1963).

The evidence presented before me clearly establishes that the specification of the patent in suit complies with this requirement of Section 112. Dr. Chipman testified as follows (R. p. 533):

> "Q. Would you please tell us whether or not that patent discloses the features of the basic oxygen or LD process as you have described it and illustrate it in your charts?
>
> A. It does."

Dr. Chipman further testified (R. p. 580):

"Q. Now, Doctor, referring again to the teachings in the patent, would you tell us whether or not those teachings that you have described in some detail are seufficient to enable one skilled in the art to utilize the process?

[43] A. Yes, in my opinion, they are.

Q. And in your opinion, would the teachings of the patent in suit which you have described be adequate to enable those skilled in the art to utilize the process for each of various sizes: 35, 80, 150, 200 tons, and so forth?

A. Yes, I see no great difficulty in that."

Mr. Prince testified as follows: (R pp. 3477-3482):

"Q. Now, are you familiar with the Suess et al., patent in suit, No. 2,800,631?

A. Yes.

Q. What does that patent teach you as one skilled in the art as to the principles of the process described therein?

A. It teaches me how to refine molten impure iron in the presence of a slag and in a refractory lined vessel by means of blowing with oxygen.

It tells me that the stream of oxygen must be directed vertically downwardly at substantially the center of the bath so that it goes through the slag and engages with the metal of the bath.

By doing this, part of the reactions take place with part of the iron of the bath and with the impurities in the molten charge, and this takes place without deep penetration and in the high temperature localized reaction zone, which is spaced away from the sidewalls and the bottom and in the upper regions of the bath.

In achieving this localized reaction zone, a circulation of the liquid bath is induced and those parts of the molten charge which are away from this localized reaction zone are brought to it and oxygen reacts

with them in this high temperature reaction zone; this all taking place in a central position in the upper regions of the bath whereby there is minimum damage to the refractory lining at the walls or at the bottom.

Q. What does it teach you as one skilled in the art as to the causes of circulation?

[44] A. The causes of circulation are due to the chemical reactions and the mechanical action of the oxygen jet plays a very minor part, and this I know because of the very great diminution in activity at the end of the blow when the carbon level is at a very low figure, and compared with earlier in the heat, the sounds and evidence of mechanical action of the jet are slight.

Q. Where do the reactions which you have spoken of which cause refining of the metal take place in accordance with the teachings of the patent? In other words, are they confined to this localized reaction zone or do they take place elsewhere in the bath or in the converter?

A. They take place elsewhere in the converter.

Q. Only or what?

A. No. The localized reactions zone is the center of the reactions of the oxygen stream with the bath, but there is developed a general boil and a reaction in all parts of the bath.

Q. You spoke about this diminution of the activity at the end of the heat or near the end of the heat. Does the patent specifically teach you that that takes place?

A. Yes.

Q. What does the patent teach to you as one skilled in the art as regards the criteria which a steelmaker can look at and see the extent of penetration of the oxygen jet into the bath?

A. It teaches to blow in such a way that a surface reaction only is not obtained, and in such a way that there is no excessive slopping during the process.

It also teaches that it is not necessary to blow deeply, by which an early fluid slag is difficult or impossible to achieve and by which phosphorus removal is not adequate.

Q. Well, my point is this, Mr. Prince. Are these things the steelmaker can determine?

A. Yes.

Q. In other words, he can look at the vessel and see whether he is getting an excessive amount of slopping, can he?

[45] A. Yes.

Q. And he can examine his steel and find out what the phosphorus removal is?

A. Yes.

Q. Can he look at the slag and tell anything about the progress of the heat or what is going on?

A. He can tell from the activity in the vessel and the signs from this activity if he is blowing according to the method described in the patent.

Q. And can he look at the refractories and tell whether he is getting excessive wear of these?

A. Yes.

• • •

Q. Are the teachings of the patent limited to vessels of any particular size, Mr. Prince?

A. No.

Q. To you as one skilled in the art, is the patent limited as to the size of the heats which may be blown?

A. No.

• • •

Q. To you as one skilled in the art, are the patent teachings limited in regard to the pressures and flows which can be used, bearing in mind, of course, the broad teachings which you have described earlier?

A. No.

Q. Are the teachings limited with respect to the bath depth or the diameter of the bath, bearing in mind the main teachings of the patent which you described a moment ago?

A. No, not bearing in mind the teachings in the patent.

Q. Are the teachings of the patent in suit sufficient to enable you as one skilled in the art to practice the LD or basic oxygen process of the patent in suit?

[46] A. Yes."

Dr. Elliott testified (PX-504, pp. 6173-74):

"Q. Would you, as one skilled in the art, with the teachings of the patent before you, have any difficulty practicing the invention taught by the patent utilizing heats of 30, 35 or 40 tons?

A. No. That patent teaches sufficient information so that one can design and operate such an installation.

• • •

Q. Would you, as one skilled in the art, with the teachings of the patent before you, be able to apply the process of the patent to making heats of 60, 100 or 150 tons?

A. Yes."

Chief Justice Waite stated in *The Telephone Cases*, 126 U.S. 1, 536 (1888):

"The law does not require that a discoverer or inventor, in order to get a patent for a process must have succeeded in bringing his art to the highest degree of perfection. It is enough if he describes his method with sufficient clearness and precision to enable those skilled in the matter to understand what the process is, and if he points out some practicable way of putting it into operation."

The testimony of the distinguished experts clearly reveals compliance with this requirement.

A patent specification is not a blueprint for the execution of a process, but rather is a general description of a process which serves to convey particular information to one skilled in the art so as to enable him to practice the invention or learn where his activity might infringe on the protected [47] area. In *Ansul Company* v. *Uniroyal, Inc.*, 448 F.2d 872 (C.A.2 1971) *cert. den.*, 404 U.S. 1018 (1972), the Court of Appeals cited with approval the determination of the trial court that the necessity for conducting experimentation or preliminary tests by one attempting to follow the teachings of a patent would not invalidate the patent provided that the experimentation involved was not unreasonable. That is, to require one skilled in the art to conduct certain experimental tests or to determine operational variables is not an unreasonable requirement.

The Suess et al. patent presents a novel concept in general terms. As is stated in the patent (col. 9, lines 12-20):

> "In general, it may be stated that as the oxygen pressure and nozzle diameter are increased, the nozzle spacing is also increased, for example, as the capacity of the refining vessel and total charge is increased. Under these conditions, deep penetration of the molten metal bath is avoided, while the necessary displacement of the slag cover to maintain direct oxygen to molten metal contact is insured."

It is not the intention of patent law to require that a patent specification become a general production or operational manual. "Obviously, it is not necessary that an applicant be more specific than is required by Section 112, portion (A). Not every last detail is to be described, else patent specifications would turn into production specifications, which they were never intended to be. United States specifications have often been criticized as too cluttered with details to give an easy understanding of

what the invention really is." **[48]** *Application of Gay*, 309 F.2d 769, 774 (C.A.3 1962).

Thus, it would appear that where the specification is of sufficient clarity to permit one skilled in the art to practice the invention, the fact that a reasonable amount of experimentation is required of such a person, does not invalidate the specification under Section 112.

In reviewing the present patent, it appears that in addition to the general statement at col. 9, lines 13-17, the specification also speaks in general terms at col. 3, line 49 to col. 4, line 6.

> "It has been determined in application of the present invention to the refining of predominantly molten pig iron charges by means of high purity oxygen, that the jet blown onto the surface of the molten iron, as above described, under a relatively low static pressure at the point of origin, for example, at the overhung blast nozzle, of from 5 to 25 atmospheres (about 75 to 375 pounds per square inch), preferably at about 8 to 12 atmospheres (about 115-175 pounds per square inch), with the jet diameter at the point of origin or blast nozzle about 1 millimeter (1/25 inch) per ton of charge, and with the point of origin or blast nozzle spaced from the bath surface from at least 150 millimeters (about 6 inches) up to about 2000 millimeters (about 80 inches), produces a sufficiently high reaction velocity of the oxygen with the bath constituents to insure the development of autogenous heat at a rate sufficient to provide the heat required for completion of the refining in a minimum of time, consistent with controlled temperature and control and development of other necessary and required process conditions, such as fluid slag, *avoidance* of over-oxidation (undue loss of iron to the slag), and *avoidance* of slopping. The process conducted under these conditions *avoids* a deep penetration of the oxygen gas into the molten bath which seriously impairs refractory life at the bottom of the refining vessel. In addition, the impingement area of the high purity oxygen on the central **[49]** portion

of the bath isolates the refractory walls of the refining vessel from the extremely high temperatures which are developed by the direct reaction of the oxygen and the molten metal." (Emphasis added)

While of necessity, a process of this variability can only be described in terms of general operating parameters, the specification does conclude with one example designed to illustrate how in actual practice the conversion is completed (col. 10, lines 29-75):

"A closed bottom converter of normally 30 tons (metric) capacity is charged with a total of about 36 tons of metal through an open mouth. The oxygen lance is inserted through the mouth of the converter to the adjusted distance above the metal converter to the adjusted distance about the metal surface. The diameter of the surface to the bath with such a charge is about 5 meters and the depth of the bath about 1 meter. A typical cycle of operations is given below on a time table basis . . ."

There then follows a detailed description of events from "0" hours to "0.42-0.45" hours at which time the steel is poured. Included in this description is the amount of scrap charged; the amount of pig iron poured from the mixer; the addition of fluxing materials, the "introduction of nozzle, oxygen jet initiated at a nozzle pressure of 10 atmospheres (147 p.s.i.) with a nozzle spacing above the bath of 1000 millimeters"; the addition of iron slag and limestone chips; the reduction of the oxygen pressure; the withdrawal of the nozzle; the sampling of the contents of the converter; the draw off of the slag; the addition of Spiegel iron; the stiffening of the remaining slag, and finally the pouring [50] of the steel. The example concludes with an analysis of the final product (col. 10, lines 68-75):

"Final test analysis on pouring into ingot mold was: 0.07% C, 0.32% Mn, 0.022% P, 0.020% S, 0.0035% N. Oxygen consumption 1950 cubic meters. This oxygen

> consumption is about 54 cubic meters (measured at standard conditions) per ton and compares with a theoretical oxygen requirement of 51 cubic meters (measured at standard conditions), and therefore indicates an oxygen efficiency of 95%."

The patent specification therefore, in very general terms describes a process whereby pig iron can rapidly be converted into steel with a significant savings in both capital and operating costs. The example illustrates but one set of specific conditions under which the conversion can be successfully accomplished.

Chief Justice Waite stated in *The Telephone Cases, supra.*, at p. 536:

> "The law does not require that a discoverer or inventor, in order to get a patent for a process, must have succeeded in bringing his art to the highest degree of perfection. It is enough if he describes his method with sufficient clearness and precision to enable those skilled in the matter to understand what the process is, and if he points out some practicable way of putting it into operation."

Therefore, it is not necessary that a patentee describe all possible applications of his process, or all conditions under which it is to be utilized; all that is requested is that the specification convey with sufficient clarity the fundamental processes of the invention which would enable one skilled in the art to practice the invention, even though he might conduct reasonable experimentation to adapt the process to his [51] particular circumstances.

In his closing argument for the plaintiffs, one of the plaintiff's counsel, offered a simplistic example which illustrates this concept (FA p. 340):

> "The best cook in my family is my sister, of sainted memory. She used a Settlement cookbook. My other sisters used to complain very bitterly. They said her stuff came out much better than theirs did, when they

all used the Settlement cookbook. One day they rebelled and they all descended upon her—she lived in a little town outside of Chicago—and they said, 'How come that our stuff is not as good as yours? Now we want to watch you.'

Well, my sister then bakes whatever she did, and they watched it. She followed the Settlement cookbook. But she added another little piece of butter and a little more sugar, and another egg. And then she got a better product than they did. She never told them about that.

Did that change the essential recipe?—No. She could not have done it without the Settlement cookbook. Those small variations do not upset a recipe. It is still a good recipe."

Thus, a small variation in the operation of the basic process does not alter its essence. It is merely a slight variation in response to the necessity or skill of the operator.

A further point which warrants brief discussion here, although it has been elaborated upon previously, concerns the specification teaching of avoidance of "deep penetration" (col. 3, line 46). "Expressions quite as indefinite as 'high' and 'substantial' in describing an invention or discovery in patent specifications and claims have been recognized by this [52] Court as sufficient." Eibel Process v. Minnesota and Ontario Paper, 261 U.S. 45, 66 (1923). See also, *Chicago Pneumatic Tool Co.* v. *Hughes Tool Co.*, 97 F.2d 945 (C.A.10 1938), cert. denied, 305 U.S. 643 (1938).

From the testimony here, I conclude that avoidance of deep penetration is meaningful to those skilled in the art of steelmaking. I therefore conclude that the specification is not indefinite and that it describes the process in full, clear, concise and exact terms which would enable one, skilled in the art of steelmaking to practice it. Further specifics are not required. *Corning Glass Works* v. *Anchor*

Hocking Glass Corporation, supra.; Continental Can Company, Inc. v. *Crown Cork & Seal, Inc.*, 281 F.Supp. 474 (E.D.Pa. 1967), vac. 415 F.2d 601 (PA3 1969) on other grounds *cert, den.*, 397 U.S. 914 (1970).

F. *The claims*

The defendant further alleges that the claims of the patent in suit fail to comply with the requirements of Section 112, which states:

> ". . . The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention. A claim may be written in independent or dependent form, and if in independent form, it shall be construed to include all the limitations of the claim incorporated by reference into the dependent claim."

[53] The specification of the patent in suit teaches that:

> "According to the process of the invention, the high purity oxygen jet is blown vertically, or approximately vertically upon the central portion of the surface of a bath of the molten metal, the jet having a diameter and static pressure at the point of origin, that is, at the blast nozzle or other jet producing means, and the point of origin (blast nozzle) being spaced from the bath surface, such that direct contact of the oxygen jet and the molten metal is established and maintained throughout the refining period *without deep penetration* of the molten metal bath by the jet. In so operating, the area of jet impingement is controlled to produce a relatively confined zone of direct oxygen to molten metal contact with respect to the total surface area of the bath . . . produces a sufficiently high reaction velocity of the oxygen with the bath constituents to insure the development of autogenous heat at a rate sufficient to provide the heat required for completion of the refining in a minimum of time, consistent with controlled temperature and control and development of other necessary and required process conditions, such as fluid slag,

> *avoidance of over-oxidation* (undue loss of iron to the slag), and *avoidance of slopping*. The process conducted under these conditions *avoids a deep penetration* of the oxygen gas into the molten bath which seriously impairs refractory life at the bottom of the refining vessel. In addition, the impingement area of the high purity oxygen on the central portion of the bath isolates the refractory walls of the refining vessel from the extremely high temperatures which are developed by the direct reaction of the oxygen and the molten metal." (col. 3, line 36 to col. 4, line 6) (Emphasis added)

From the specification, it becomes clear that the process of the patent in suit consists of blowing extremely high purity oxygen or pure oxygen centally downward *onto and below* the surface of the molten metal bath so as to penetrate the fluid slag layer but only penetrate the molten iron to a limited extent. This lack of deep penetration insures an early fluid **[54]** slag which is essential for adequate phosphorus removal, prevents over-oxidation of the iron ore resulting in an increase in yield, and produces a relatively localized reaction zone spaced a substantial distance from the refractory walls. This latter condition prevents injury to the refractories *thereby* augmenting their useful life. However, the penetration must be more than a mere surface phenomenon to avoid undesirable slopping.

While the degree of penetration which will be deep enough to prevent slopping yet not so deep as to cause injury to the refractory or prevent the formation of an early fluid slag is described in general terms in the specification, the precise balancing of these variable conditions is left to the expertise of the steelmaker as his particular operating parameters and goals dictate.

Noting the above, it now becomes necessary to specifically focus attention on the claims, which by statutory mandate must follow the body of the specification.

It is provided in col. 12, lines 11-29:

"We claim:

1. Method of refining molten impure iron in the presence of a slag in a vessel having a refractory lining by blowing with oxygen, which comprises discharging a stream of oxygen *vertically* downwardly through the slag layer *onto and below* the surface of the bath at the *central portion* thereof, to an extent to *avoid material agitation* of the bath by the oxygen stream, the contact of the oxygen with the bath resulting in reaction of the oxygen with a portion of the iron and with the oxidizable [55] impurities of the bath in a *localized reaction zone* spaced a substantial distance from the refractory lining, the reactions in said zone resulting in refining of the iron and gas evolution and in the production of high temperature in the reaction zone away from the refractory lining, said reaction producing a *circulatory movement* in the molten metal, which circulatory movement brings those portions of the molten metal bath which are remote from the reaction zone into the reaction zone whereby those portions are subjected to said reaction with minimum injury to the refractory lining. (Emphasis supplied)

2. The gaseous oxygen process set forth in claim 1 in which the oxygen is blown into said vessel under pressure in a range between about five and about twenty-five atmospheres above normal atmospheric pressure."

It is the wording of the claims which caused the *McLouth* District Court to conclude that:

"On the state of this record, this Court is obliged to conclude that the avoidance of deep penetration by the jet is not necessarily causally related to the claim of avoiding 'material agitation of the bath by the oxygen stream.' In other words, it appears to this Court that even deep penetration would avoid material agitation as defined by the plaintiffs . . . no such causal relation has been established in this record that would entitle plaintiffs to read the avoidance

of deep penetration into the language of the claim referring to the avoidance of material agitation of the bath by the oxygen stream." (257 F. Supp. at page 426)

Based on the lack of connection between the concept of avoiding deep penetration as contained in the specification and the concept of avoiding material agitation as contained in the claims, Judge Freeman "reluctantly" reached the conclusion that the patent in suit was invalid.

Because the *McLouth* District Court erroneously believed that the essence of the Suess et al. patent was embodied in the [56] concept of avoiding deep penetration of the bath by the oxygen stream, it felt compelled to conclude that the claims of the patent did not incorporate this concept. In a suit in which the scope or interpretation of patent claims are in dispute, the entire patent history becomes relevant. *Waldon, Inc.* v. *Alexander Manufacturing Company,* 423 F.2d 91 (C.A.5, 1970).

A " . . . patentee is entitled to select his own language as long as his meaning was reasonably plain and specific." *Elipse Corporation* v. *Ford Motor Company,* 312 F.Supp. 646, 660 (N.D. Ill., 1969), modified on other grounds (C.A.7 1971); 452 F.2d 163 (C.A.7 1971); cert. denied, 406 U.S. 948 (1972); rehearing denied, 409 U.S. 898 (1972). Thus, in an effort to demonstrate the logical connection between these two concepts, the plaintiffs here presented the deposition of the patent examiner, Claude A. LeRoy (PX-1002), and the testimony of Byron Gardner, Esq., who had the primary responsibility for the prosecution of the patent before the Patent Office. While these have been discussed previously, a very brief summary is appropriate here because of their critical nature.[18]

[18] On April 29, 1970 at the first post trial hearing, the defendant raised an objection that this testimony was immaterial and that it violated the Parol Evidence Rule. I considered that even if the pat-

In his deposition, Mr. LeRoy testified that he was the primary examiner when the Suess et al. patent was before the Patent Office for consideration; that the assistant examiner and the prosecuting attorneys were unable to arrive at a mutual agreement and requested an interview with him in his capacity as primary examiner; that the policy of the Patent Office is to avoid the use of negative language in the claims to the [57.1] extent such is possible; that as primary examiner, LeRoy believed that the language "avoid deep penetration" was not the proper wording for claims; that the concept of deep penetration was well understood in the art, and that as primary examiner he believed that it would be more appropriate to emphasize the inventive feature of a localized penetration; that while he did not remember who had suggested the use of the term "without material agitation" in place

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ent was a contract, the evidence here is merely explanatory of what occurred while the contract was being formulated.

The contractual nature of a patent is well documented in the federal judiciary, *Goodyear Dental Vulcanite Co.* v. *Davis*, 102 U.S. 222 (1880); *Texas Co.* v. *Anderson-Prichard Refining Corp.*, 122 F.2d 829, C.A. 10, 1941. Recognition of this status had inevitably involved simultaneous acceptance of the well-known contract rule that parol, or outside, evidence may be received to interpret the patent (or contract), but not to enlarge, diminish or vary the language, *Goodyear Dental Vulcanite Co.* v. *Davis, supra*, at page 227; *Van der Horst Corp.* v. *Chromium Corp.*, 98 F.Supp. 412, 420 (S.D. N.Y. 1951).

Though I have also considered the possible conflict between Patent Office Rule 1.2 and my allowance of evidence concerning patentees' negotiations with the Patent Office examiners, although they were not recorded verbatim in the file wrapper, the negotiations were referred to there (PX2A, at page 74). As was stated in Lavell Aircraft Corp. v. United States, 358 .2d 1005, 1007-1007 (Ct. Cl., 1966): "For purposes of determining whether or not an accused structure infringes a claim, the claim *must* be interpreted not only in light of the specification but *also with reference to the statements made to secure the allowance of patent claims.*" (citing cases) (Emphasis added). See also Opinion Compendium XVIII, pages 396-397.

of "avoid deep penetration" he did feel that the former statement was a more positive expression of the concept; and that he believed that there existed an identity of meaning between the phrases "material agitation" and "turbulence". While it is difficult to understand how the term "without material agitation" is any less negative than the concept of "avoid deep penetration", we nevertheless have here the unbiased and uncontradicted testimony of the primary examiner that in his opinion one was less negative than the other, and that there existed in his mind a synonymity between these two terms.

At the hearing held here on April 29, 1970, Attorney Byron Gardner testified that he had the primary responsibility for the prosecution of the Suess et al. patent before the Patent Office; that on May 1, 1957, a meeting was held between counsel for the prosecutor, and members of the Patent Office staff; that in the presence of the primary examiner, Mr. LeRoy, and an assistant examiner, the prior art and especially the Miles patent were discussed; that the contents of the Rinesch affidavit were discussed; that the examiner considered the invention to [58] be "a remarkable improvement" but that he did not like the language in the claims; that because of the equivalency of the rate of blowing and the height of the nozzle, the examiner suggested modifying the claim to provide "to such an extent—without material agitation"; that the primary examiner, Mr. LeRoy, interlineated those words in the claims; that the distinction was one of language rather than one of substance; that Mr. LeRoy believed that the expression "without material agitation" was a more definite limitation and better defined the invention than the expressions "avoidance of deep penetration" or "without deep penetration"; that the examiner indicated that the patent would issue based on the modified claims; that he prepared the amended application which was filed on June 11th; that at a further meeting at the Patent Office on June 13, 1957,

at which he was not present, further changes in the claims were made; that these changes were made in a supplemental amendment, and that after several slight informalities were attended to, the patent issued.

The testimony presented at the second post-trial hearing held on September 7, 8 and 9, 1971, on the issue of collateral estoppel has been thoroughly set forth previously. However, because the testimony of the expert witnesses ly critical at this juncture, it warrants repetition.

The witnesses called were David L. Ladd, lawyer and former commissioner of patents from 1961 to 1963; William E. Schuyler, Jr., a patent lawyer and a former commissioner of [59] patents from 1969 to 1971; and Robert B. Larson, a patent attorney and a former President of the American Patent Law Association in 1960-1961, and following that Chairman of the National Council of Patent Law Associations. On the question of collateral estoppel, Dr. John F. Elliott, Professor of Metallurgy of the Massachusetts Institute of Technology, who had testified as an expert at the *McLouth* trial, attempted to demonstrate the lack of technical understanding of the *McLouth* Courts.

The first witness, Mr. Ladd, testified that the Rinesch and Hauttmann affidavits (PX-2A) were included in the file history and would not have been obvious to anyone until the patent was issued, because until that time the entire contents of a file are unavailable to the public; but that upon issue, the entire file wrapper record becomes public and nothing could possibly be obscured in the file (CE pp. 60-62), even though such an obscurity was determined to exist by both the D.C. (257 F.Supp. at 431) and the *McLouth* Court of Appeals (400 F.2d at 50). He testified further that the examiner in the Patent Office ordinarily consults the specification and the file wrapper in order to precisely ascertain the meaning of particular terms (CE pp. 70-71); that the Schwarz patent was vol-

untarily brought to the attention of the Patent Office (CE p. 89); that cancellation of a phrase and substitution of another is not an abandonment of the original concept (CE p. 113); and that the record disclosed that "the Examiner was aware of **[60]** and applied the statutory provision of definiteness" (CE p. 156).

The testimony of William E. Schuyler, Jr., who served as the Commissioner of Patents during a term from 1969 through 1971, was in a large measure cumulative of Mr. Ladd's testimony. He did testify, however, that the final Suess claims did not constitute an abandonment of the earlier language, but rather represented a more precise statement of the claims (CE p. 186); that Claim No. 16 which spoke of avoiding deep penetration was still pending when the new claims and affidavits were filed (CE p. 188); that the final terms of a patent are gradually arrived at through a give and take negotiation process between the examiner and the applicant (CE p. 189); that a failure to list Schwarz in the reference cited at the end of the patent, was not indicative of failure by the examiner to consider the Schwarz patent (CE p. 192); that a change in the language of a claim does not constitute an abandonment of the concept (CE p. 205); that "Abandonment of language and abandonment of concept are two different things" and that in his expert opinion the applicants changed the language but not the concept (CE p. 231).

Robert R. Larson, patent attorney and President of the American Council of Patent Law Associations during 1960-1961, testified that in construing and interpreting a patent it is necessary to consider its entire file wrapper history (CE pp. 303-305); that when claims are rewritten an abandonment **[61]** does not necessarily occur; that "The mere rewriting of a claim with the use of different phraseology in and of itself certainly does not constitute an abandonment of what was previously claimed" (CE p. 307); that where the file wrapper under certain circum-

stances indicates an abandonment, that would be different, "But mere language is not" (CE p. 307).

When asked:

> "Q. Where new claims, however, are submitted after the cancellation of the claims and there is nothing in the file history to indicate an intent to abandon, do the cancelled claims and the submitted new claims give rise to this matter of abandonment?
>
> A. Oh, no, certainly not." (CE p. 307-308)

Mr. Larson testified that at the time the patentees canceled their original claims Nos. 1 through 4, they submitted Claim 12 which spoke of avoiding deep penetration. This showed the continuity of the concept and lack of any attempt to abandon it (CE pp. 317-318). At the time the supplemental amendment was filed on June 11, 1957, Claims 15 and 16 were still in the application. Then the prior claims were canceled and new claims 17 and 18 substituted therefor (CE p. 319-320). By the amendment filed on June 11, 1957, the language of Claim 17 was changed to avoid the negative limitations (CE p. 325); and since new matter cannot be introduced in an application by means of amendment, it can be assumed that the amended claims did not in the view of the examiner introduce any new matter (CE p. 330).

[62] This critical evidence was not available to the *McLouth* courts for their consideration. While it is true that the *McLouth* District Court allowed the plaintiffs broad latitude in presenting evidence, the plaintiffs now contend that because the issue of file wrapper estoppel was not raised in the pleadings or the pretrial or trial proceedings and did not arise until the trial judge filed his opinion incorporating the doctrine of file wrapper estoppel, that they were unable to present these critical matters.[19]

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[19] The plaintiffs do not dispute the *McLouth* District Court's right to raise the doctrine of file wrapper estoppel *sua sponte*, but

Thus it can be seen from the additional evidence that the plaintiffs did not intend to abandon the concept of avoiding deep penetration. I surmise that if this evidence had been presented before the *McLouth* District Court as fully as it has been presented before me, the *McLouth* Courts might very well have reached a different conclusion.

As the Court said in *Schriber Scrath Co.* v. *Cleveland Trust Co., supra,* at pages 217-218:

> "The claims of a patent are always to be read or interpreted in the light of its specifications . . . and we may assume that if in the present case the specifications and claims of the patent were to be interpreted without reference to its file wrapper history,
> [63] the webs referred to in the claims are the webs described in the specifications as capable of bending in cooperation with the slotted piston guides or skirts so as to compensate for thermal expansion and so supply the element of webs laterally flexible which was wanting to Gulick and to Maynard. But the particular invention to which the patentee has made claim in conformity to the statute is not always to be ascertained from an inspection of the specifications and claims of the patent alone. Where the patentee in the course of his application in the patent office has, by amendment, cancelled or surrendered claims, those which are allowed are to be read in the light of those abandoned and an abandoned claim cannot be revived and restored to the patent by reading it by construction into the claims which are allowed."

Therefore, by this language the Supreme Court made it clear that the claims of a patent are not to be interpreted in isolation but rather in reference to the entire history of the patent prosecution, and especially in view of the prior rejected claims. *Graham* v. *John Deere,* 383 U.S. 1 (1966); *Schmidinger* v. *Welsh,* 383 F.2d 455 (C.A. 3 1967), *cert. denied,* 390 U.S. 946 (1968). Furthermore, the United

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rather claim that they were not prepared to rebut this defense because it was not raised until after the trial was completed.

States Court of Appeals for the Third Circuit has stated that "The law is settled that a patent should not be struck down or its claim unnecessarily limited where a reasonable construction of the specifications and claims will protect the invention." *Corning Glass Works* v. *Anchor Hocking Glass Corp., supra,* at page 478.

It is, therefore, imperative that an examination of the file wrapper history be made.

[64] **File Wrapper History**

On January 16, 1951, an original application (PX-2B) providing a "Method of Carrying Out Melting Processes" by the "treatment of metallic or metal-containing materials with oxygen-containing gases and which ". . . has particular relation to a process of this type, in which fusable materials are treated at high temperatures with said gases," was filed in the Patent Office.[20] The application continues,

> "The main object of the present invention is to provide a process . . . in which, owing to the particular conditions of the invention, the walls of the apparatus used in carrying out the process, are protected from undue corrosion by excessive temperatures and chemical reactions taking place at such temperatures.
>
> Another object . . . is to carry out the treatment of molten materials at high temperature with oxygen-containing gases in such manner that reaction of oxygen with ingredients of the molten bath, results in a beneficial circulation of the molten material . . ." (PX-2B, p. 1).

The specification recognized the necessity for such a procedure because of the limited life of the refractory lining which excited when the prior art was practiced (PX-2B, p. 1). The application further states (p. 2):

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[20] All references in this part of the discussion will be to the pages in the original application. (PX-2B)

"It has now been found that by suitable arrangement of the nozzle or the like, used for the introduction of gases, in combination with a suitable design of the device, in which the process is carried out and the use of certain predetermined amounts of materials to be treated in one batch, a very efficient protection of the refractory lining of the device, can be obtained."

[65] By starting with a suitable ratio of depth of bath to surface area, and applying the stream in a vertical or near vertical direction, a down-in-center circulation is achieved. The practice of blowing under a low pressure of between 5 and 25 atmospheres through a 15-35 mm. diameter nozzle, brings about a sufficiently high reaction velocity without deep penetration of the gas into the molten bath and the creation of a high quality finished product. (p. 3).

The application further speaks of the creation of a "local reaction between the oxygen and the carbon present in the iron . . ." (p. 3), and alleges another advantage of the process, i.e., ". . . the fact that deoxidizing agents can be dispensed with, means that refining with oxygen takes place without an excess of oxygen, which would be a harmful effect on the properties of steel." (p. 4).

Thus, in the original 1951 application we see the emergence of the dominant themes of blowing from above vertically upon the central bath surface at a sufficiently high pressure to insure sufficient reaction velocity, yet not so strong as to interfere with the down in center circulation. Furthermore, following the teachings of the application, a localized reaction zone is created, and at the same time adequate protection for the refractory linings is provided. Appended to the directions was the conclusion that blowing as directed "brings about a sufficiently high reaction velocity without deep penetration of the gas into the molten bath." (p. 3) **[66]** This language, in similar form, permeates the entire Suess et al. application.

The original application concluded with 12 claims the first of which is most graphic and speaks of blowing onto the center surface of the bath thereby creating a downward circulation (p. 10). The remaining claims repeat the general theme of creating a down in center circulation and provide specific examples (p. 10-12). On June 25, 1951, the Patent Office rejected all claims citing amongst other reasons, the Chiswik patent (p. 15-16). On December 14, 1951, an amendment was filed which made small changes in language (p. 17-19), and specifically stressed, ". . . circulation of the molten mass which is a fundamental feature in the applicant's invention . . . such circulation does not occur unless it is deliberately brought about by corresponding operating conditions." (p. 18)

On June 26, 1952, the entire amendment was rejected for reasons which included indefiniteness and lack of invention over Chiswik (p. 20-21). On December 22, 1952, additional amendments to the claims were made, which contained slight changes in language but nothing of major significance (p. 23-25). A supplemental amendment was filed on February 20, 1953, which spoke of down in the center circulation (p. 26-29). These amended claims were rejected on August 20, 1953, as failing to define the invention over Chiswik, Lane, Brassert and Miles. In that rejection it was stated that the application should be prepared for final rejection (p. 30-32).

[67] On February 15, 1954, an amendment and new claim 13 were filed. This claim likewise spoke of a downward circulation (p. 33). All thirteen claims were rejected over Chiswik on September 20, 1955, in the notice of final rejection (p. 39).

A Notice of Appeal was filed on March 21, 1956 (p. 42). However, on March 23, 1956, an amendment was filed which canceled all claims and at the same time added claims 14 and 15 (p. 43). Claim 14 stated:

> "A gaseous oxygen process for producing steel from a molten predominantly pig iron-containing metal

charge containing oxidizable impurities in a refractory-lined converter having a bottom merging into substantially vertical side walls, said charge having a slag cover, and in which the heat required for the refining is produced by the reaction of oxygen with the oxidizable impurities in the metal, which comprises blowing a jet of high purity oxygen substantially vertically *onto a restricted impact area of the surface of the molten metal charge* in said converter from a restricted nozzle having an orifice diameter between about fifteen and about thirty-five millimeters, said impact area being located directly beneath said nozzle orifice and being spaced at the greatest possible distance from the side walls of the converter, maintaining the nozzle orifice spaced a substantial distance above the said surface and within the converter, and feeding the oxygen from said nozzle orifice at a relatively low pressure of between about five and about twenty-five atmospheres above normal atmospheric pressure, the total volume of oxygen supplied during refining being about $100m^3$ per ton of molten steel, the *pressure, orifice diameter and nozzle opening being such as to avoid deep penetration* of the oxygen jet into the molten metal . . ." (pp. 43-44) (Emphasis supplied).

Claim 15 contained a specific ratio of depth to diameter of the molten charge.

[68] By notice mailed April 9, 1956, claims 1 through 13 were canceled, and claims 14 and 15 were rejected (p. 48). Thus, no claims were allowed. On June 4, 1956, the United States Patent Office Board of Appeals dismissed the appeal for failure to file a brief (p. 86), and specifically, by letter mailed June 22, 1956, the Patent Office stated that "Since no claims were allowed, the case stands abandoned." (p. 7)

However, before this abandonment, and closing of the original application on November 16, 1955, the applicants filed a continuation-in-part application.[21] The specification

[21] All references in this section of the discussion will be to the pages of the applicants' continuation-in-part application, PX-2A.

of the continuation-in-part application which eventually resulted in the issuance of the patent in suit states:

> "This invention relates to a process for the treatment of metallic or metal-containing materials with oxygen-containing gases, preferably high purity oxygen, and has particular relation to a process of this type in which fusible materials are treated at high temperatures with said gases. Still more particularly, the invention relates to a process for the refining of molten metal with high purity oxygen blown downwardly onto the surface of a bath of molten metal." (p. 1)

Thus, in its opening words the specification succinctly recites the scope of the application, i.e., *a process for the manufacture of molten metals by treating the cruder ores with high purity oxygen blown downwardly onto the surface of the molten metal bath.* From this point onward, the specification [69] teaches how to apply the oxygen stream so as to (1) create a localized reaction zone, (2) create the down in center circulation, (3) preserve the life of the refractories, and (4) produce a satisfactory end product. It teaches that in order to achieve success, one must avoid deep penetration of the bath by the oxygen stream.

It is accordingly one of the main objects of the present invention to provide a process for refining molten metals by surface blowing with high purity oxygen, in which, owing to the particular conditions employed, the refractory walls of the apparatus utilized . . . are protected from undue corrosion by the excessively high temperatures developed and the chemical reactions taking place at such temperatures." (pp. 4-5)

"Another object of the present invention is to carry out the treatment of molten metals, and other molten materials by surface blowing with high purity oxygen in such a manner that the reactions of the oxygen gas with the constituents of the molten bath and the resulting high temperatures, to the extent possible, are limited to an oxy-

gen jet impingement area removed from the refractory lining of the reaction vessel." (p. 5)

Amongst the further objectives claimed are: (1) achieving high theoretical oxygen efficiency (p. 5); (2) obtaining exceptionally high refractory life (p. 5); (3) preventing over-oxidation of the bath (p. 5-6) and (4) producing excellent quality steel at high production rates (p. 6).

[70] In practice, "the high purity oxygen jet is blown vertically, or approximately vertically upon the central portion of the surface of a bath of molten metal . . . such that direct contact of the oxygen jet and the molten metal is established and maintained throughout the refining period without deep penetration of the molten metal bath by the jet. In so operating, the area of jet impingement is controlled to produce a relatively confined zone of direct oxygen to molten metal contact with respect to the total surface area of the bath." (pp. 7-8).

The specification then teaches that the pressure at the point of origin should be between 5 and 25 atmospheres, and preferably 8 to 12 atmospheres (p. 8); that the jet nozzle should be about 1 millimeter (1/25 m.) in diameter per ton of charge, and spaced at least 150 to 2,000 millimeters (6 to 80 inches) from the bath surface (p. 8). This results in "refining in a minimum of time, consistent with controlled temperature and control and development of other necessary and required process conditions, such as fluid slag, *avoidance of over-oxidation* . . . and *avoidance of slopping*. The process conducted under these conditions *avoids a deep penetration of the oxygen gas into the molten bath* which seriously impairs refractory life at the bottom of the refining vessel." (p. 8) Thus, once again we observe the specific instructions of how the blowing should be conducted, and superimposed on these conditions is the outside limitation or cautionary instruction [71] to avoid deep penetration. The latter instruction being specifically directed to one skilled in the art of steelmaking in order to

augment the protection afforded the refractory lining it is taught that the ratio of the depth of the molten bath to the surface area should be between 1:5 and 1:28 (is in terms of ratio depth to diameter between 1:2.5 and 1:19). (p. 9) The specification further expresses the belief that applying the oxygen jet approximately vertically at the central portion of the bath surface brings about the desired down in center circulation (p. 10), enabling continuation of the reaction in a localized reaction zone (p. 10). Furthermore, it is taught that this desired circulation is augmented by the strong boil resulting from CO formation as the result of the vigorous carbon combustion (p. 11).

"The oxygen jet thus contacts the emulsion of bath and slag components which presents a larger reaction surface and causes the refining reactions to progress rapidly although the oxygen jet does not penetrate deeply into the molten metal bath and is confined to an impingement area at the central portion of the bath surface." (p. 11) Thus, once again one is reminded that observance of the instructions insure the cautionary limitation of not deeply penetrating the bath by the oxygen stream.

By so restricting the reaction zone the vigorous boil resulting from the carbon combustion "is opposed by the pressure of the oxygen jet only in the area of impingement" [72] (p. 11) and the localized endothermic reaction thus produced restricts the area in which the highest temperatures are obtained to the central surface area of the bath, and thereby provides "a maximum measure of protection to the refractory lining of the refining vessel." (p. 11)

A characteristic of the confined reaction zone at the central portion of the bath surface is the generation of an early fluid slag which is highly oxidizing (p. 14), and provides "an accelerated rate of phosphorus and sulfur removal" (p. 15) which is highly desirable in the production of high quality steel.

On page 23, a specific illustration is provided in which "30 ton converters charged to 35 to 36 tons, oxygen pressures at the blast nozzle of about 8 to 10 atmospheres and oxygen jet or blast nozzle diameters of from about 27.5 to 35 millimeters (1.1 to 1.4 inches) with nozzle spacings varying from 25 to 50 inches (about 650 to 1250 millimeters) have been used, the preferred spacing being from 30 to 40 inches (about 750 to 1000 millimeters). In general, it may be stated that as the oxygen pressure and nozzle diameter are increased, the nozzle spacing is also increased, for example, as the capacity of the refining vessel and total charge is increased. Under these conditions, deep penetration of the molten metal bath is avoided, while the necessary displacement of the slag cover to maintain direct oxygen to molten metal contact is insured." (p. 23)

[73] Once again we observe that we are told that if one follows the teachings of the specification, deep penetration of the bath by the oxygen jet is avoided. So we see that deep penetration is not a teaching of the patent but rather an intermediate result which one achieves when he observes the teachings of the specification.

As filed, the continuation-in-part application contained 15 claims, the first four of which are of specific concern to us.

In the first claim the applicant spoke of

> "A process for the refining of predominantly pig iron-containing molten metal with high purity oxygen gas, which comprises blowing a jet of high purity oxygen gas approximately onto the surface of a bath of said molten metal substantially at the central portion thereof, the point of origin of said oxygen jet being spaced from the bath surface, and the jet having a diameter and static pressure at the point of origin such that a relatively confined zone of direct oxygen to molten metal with respect to the total bath surface area is established and maintained while avoiding deep

penetration of the molten metal bath by the jet . . ." (p. 31).

The second claim spoke of

"blowing a jet of high purity oxygen approximately vertically onto the surface of a bath of said molten metal having a lime-containing slag cover, the point of origin of said oxygen jet being spaced above the bath surface, and the jet having a diameter and static pressure at the point of origin such that the slag layer is initially displaced to establish direct contact of the oxygen jet with the molten metal while avoiding deep penetration of the molten metal by the jet, and controlling the area of impingement of the jet on the bath surface such that a relatively confined zone of direct oxygen-molten metal contact with respect to the total bath surface area is established and maintained . . ." (p. 32).

[74] The third claim speaks of a process comprising

"blowing high purity oxygen gas approximately vertically onto the surface of a bath of said molten metal substantially at the central portion thereof, the jet impinging on the bath surface under such conditions that deep penetration of the molten metal by the jet is avoided, and a relatively confined zone of direct oxygen-molten metal contact is established and maintained . . ." (p. 33).

The fourth claim refers to refining

"with high purity oxygen which comprises blowing a jet of oxygen approximately vertically onto the surface of a bath of said molten metal substantially at the central portion thereof to establish and maintain a relatively confined zone of direct oxygen-molten metal contact with respect to the total bath surface area without deep penetration of the bath by the jet . . ." (p. 33).

The remaining claims contained specific illustrations of the application of the process sought to be patented.

In a letter mailed June 14, 1956, the Patent Office rejected the claims as unpatentable over the patents of Brassert, Chiswik, Cuscoleca and Miles. In addition, the claims were rejected on the ground of multiplicity and as being insufficiently differentiated (pp. 58-60).

In a response dated December 7, 1956, which was filed December 10, the applicants canceled claims 1 to 10 and added a new claim 16 which to a large extent corresponded with claim 14 of the original application (pp. 65-69).[22]

[75] A supplemental amendment filed June 11, 1957, added claims 17 and 18 (pp. 72-77). The latter claims eventuated into the two claims of the patent as issued. Claim 17 clearly spoke of "discharging a stream of oxygen vertically downwardly against the surface of a bath of the molten iron at the central portion thereof without material agitation of the bath by the oxygen stream . . . in a localized reaction zone spaced a substantial distance from the refractory lining . . ." (pp. 72-73).

In the remarks appended to the application, it is stated, "The claims of the application are cancelled and new claims 17 and 18 are substituted therefor in view of the discussion with the Examiner on May 1, 1957." (p. 74)

Included in this application were the Rinesch and Hauttmann affidavits (pp. 78-97). In his affidavit, Rinesch reveals familiarity with the work of Schwarz and Miles (p. 79); that the earlier experimentation sought to employ deep penetration (p. 79); that proceeding via the prior art did not produce satisfactory results (p. 80); that on June 22, 1949, they started a new series of experiments in which the jet did not penetrate deeply (p. 81); and that proceeding in this manner satisfactory operations were obtained (p. 81). Rinesch attributed this success to:

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[22] It will be remembered that claim 14 of the original application was filed on March 21, 1956.

> ". . . a limited center of reaction . . . created in the surface layer of the bath by blowing oxygen onto the surface through a nozzle which is placed at a considerable vertical distance from said surface . . . [76] In the aforementioned center of reaction, oxygen reacts with iron and with the elements accompanying the iron, such as silicon, manganese and carbon. Thereby, a slag is created which is rich in oxides and heat is set free. This center of reaction is hotter than the rest of the bath and the reaction velocity is very high therein. The iron which in the field of reaction was freed from the elements accompanying it has a higher density than the crude iron and sinks to the bottom of the converter. This movement is aided by evolution of gas to that the molten iron begins to circulate in the converter." (p. 82)

Rinesch concludes that steel of satisfactory purity cannot be obtained with deep penetration, and that deep penetration creates uncontrollable turbulence in the bath (p. 83).

Hauttmann stated that the work of Schwarz and Miles was known to him (p. 89); that the latter patent intended to carry oxygen throughout the bath by the agitation or stirring produced by the deeply penetrating jet (p. 89); that after experimentation, the patentees selected blowing conditions whereby the stream of oxygen did not "agitate or stir the bath materially" (p. 90); that the patentees determined "that a satisfactory refining operation of the entire bath could be obtained so long as we relied mainly upon induced circulation due to a localized reaction center as distinguished from relying upon the stirring action of the oxygen jet penetrating deeply into the bath" (p. 90); and that:

> "I am convinced that an essential characteristic of our method is that a limited center of reaction is created in the bath by blowing oxygen onto the surface through a nozzle which is placed at a considerable vertical distance from said surface, said center of reaction being spaced laterally from the side walls

> and vertically above the [77] bottom wall substantially in the surface layer and that agitation such as is caused by the deep penetration of the jet according to the methods of the prior art, together with injury to the lining, and interference with the refining action thereby are avoided." (p. 91)

In an amendment filed July 11, 1957, slight changes in the specification were made (p. 104-105). On July 23, 1957, the patent issued.

The patent in suit speaks of blowing centrally, vertically onto and below the surface of the bath under controlled conditions of oxygen pressure. If one follows the teachings of the specification one may anticipate steel comparable in quality to open-heart steel and also preservation of the refractory linings. Furthermore, the specification informs an individual skilled in the art of steelmaking, that in following the patent instructions he avoids deep penetration, i.e. he avoids the unsuccessful practice of the prior art.

The claims likewise speak of blowing vertically and centrally through the slag layer onto and below the surface of the bath creating a localized reaction zone spaced a substantial distance from the refractory lining. If one skilled in the art heeds the claims, it becomes apparent that he avoids the prior [78] art and produces open-hearth quality steel while preserving the refractories. To an individual skilled in the art, the vertical and central blowing onto and below the surface creating a localized reaction zone, by implication limits the possible oxygen pressure. Too great a pressure prevents the reaction zone from being localized, and too slight a pressure leads to slopping (R.542, 820-21). To such an individual, the relative scope of the claims is very definite. Furthermore, the claims clearly instruct that the method claimed avoids the material physical agitation of the prior art.

Thus it would appear that the term "avoidance of deep penetration" or "avoidance of material agitation" are surplusage. One cannot blow vertically, centrally onto and below the surface creating a localized reaction zone, and at the same time penetrate deeply or materially agitate the bath. The concepts are mutually exclusive (R. 570), but cautionary.

The defendant argues that "onto and below" is not discussed in the specification. However, the testimony of Dr. Chipman [79] (R.540-41) and the specification (col. 1, line 24) show the fallacy of the allegation.

In addition the language of the claims such as "to an extent" is also relative, but this is not fatal, because the law does not require identity of words but that the concept be defined from the specification as an entity. *Eibel Process* v. *Minnesota and Ontario Paper,* 261 U.S. 45, 65-66 (1923) In *Boyle* v. *Harris-Thomas,* 18 F.Supp. 177, 181 (D.C.Mass. 1937) it was stated, "The patentee is not bound to use in his claims the precise phraseology with which he sets forth the invention in his specification." See also: *Aerosol Research* v. *Scovill,* 137 U.S.P.Q. 701 (N.D. Ill. 1963) modified on other grounds, 334 F.2d 751 (C.A. 7, 1964).

As has been set forth above, the critical parameters set forth in the specification were carried over into the claims.

As to the depth of penetration, both Dr. Chipman (R. 540-41, 545-47) and Dr. Elliott (PX-504, pp. 6168-70) testified that as individuals skilled in the art, they could understand the expression. Furthermore, Mr. LeRoy also stated (PX1002, p. 8) that deep penetration was understood in the art. See: *Eibel Process* v. *Minnesota and Ontario Paper, supra; Jones Knitting* v. *Morgan, supra.*

[80] When read in light of the specification, to one skilled in the art of steelmaking, the claims are sufficiently precise to fulfill the requirement of law. For this reason, it

appears that the plaintiffs have fulfilled their statutorily imposed obligation of setting forth the subject matter of their invention so that those skilled in the art can fully understand the scope of the patent. *Graham* v. *Deere supra; United States* v. *Adams, supra; Schmidinger* v. *Welsh, supra.*

G. Lack of the necessary statutory oath

It is provided in 35 U.S.C. § 115 that:

> "The applicant shall make oath that he believes himself to be the original and first inventor of the process, machine, manufacture, or composition of matter, or improvement thereof, for which he solicits a patent . . ."

The defendant alleges that the application lacks the oath required by Section 115. With the original application filed on January 16, 1951, an oath stated:

> "Being duly sworn, I, Theodore Edward Suess, depose and say that I am a citizen of Austria residing 45 Scheibenpogenstrasse, Linz—Spallerdof, Austria; that I have read the foregoing specification and claims and I verily believe I am the original, first, and sole inventor of the invention or discovery in "Method of Carrying Out Melting Process described and claimed therein . . ." (PX-2A, p. 13).

In a "New Oath and Affidavit Under Rule 45(c) and filed May 15, 1956 it is stated:

> "We, Theodor E. Suess, Herbert Trenkler, Hubert [81] Hauttmann and Rudolph Rinesch, all Austrian nationals . . . being duly sworn, depose and say:
>
> "That during 1949 and 1950 while employed by Vereinigte Oesterreichische Eisen-Und Stahlwerke Aktiengesellschaft at Linz, Austria, we were engaged in the development of methods and apparatus for the production of steel. During the course of such employment, we jointly developed a process for the refining of iron to steel with the use of high purity oxygen . . .

> ". . . and deponents say that they verily believe that they are the original, first and joint inventors of the invention or discovery in "Method of Carrying Out Melting Process," described and claimed in application Serial No. 206,147, filed January 16, 1951, and that they do not know and do not believe that the invention was ever known or used before their invention or discovery thereof . . . (PX-2B, pp. 78-85).

In conjunction with the continuation-in-part application filed November 16, 1955, the following oath, power of attorney, and petition is annexed:

> "Being duly sworn, I, Theodore Eduard Suess, depose and say that I am a citizen of the Republic of Austria, residing at 45 Scheibenpogenstrasse, Linz—Spallerhof, Austria, that I have read the foregoing specification and claims, and I verily believe I am the original, first and sole inventor of the invention or discovery in Method of Carrying Out Melting Processes described and claimed therein . . ." (PX-2A, pp. 38-39).

[82] In addition, on May 15, 1956, the patentees filed a "New Oath and Affidavit under Rule 45(c)" which is substantially identical to the May 15 oath filed with the original application. (PX-2A, pp. 50-57).

The second oaths filed on May 15, 1956 with both the original and the continuation-in-part application resulted from protracted litigation in which it was ultimately determined that the process was the result of joint inventorship. (PX2A, p. 52; PX2B, p. 80).

Thus, it is a matter of record that all four patentees executed oaths substantially in the form required by Section 115. *Carter-Wallace, Inc.* v. *Davis-Edwards Pharmacal Corp.*, 341 F.Supp. 1303 (E.D.N.Y. 1972). Because the changes which followed the original applications were changes in form and not in substance, and did not constitute new matters, additional oaths were not required. *Aerosol Research Co.* v. *Scovill Mfg. Co., supra.*

H. Enforceability of the Patent

The defendant alleges that the patent is unenforceable because of alleged frauds perpetrated on the Patent Office, alleged misuse of the patent after its issuance and because of an alleged attempt to prevent relevant evidence from becoming [83] before the Court. Because much of this had already been discussed, it will be treated in summary form.

1. Fraud perpetrated on the Patent Office

The defendant premises its assertion of fraud on the failure of the plaintiffs to present the Durrer-Hellbruegge work to the Patent Office. As has been thoroughly discussed, the prior work of Durrer-Hellbruegge does not show that the plaintiffs derived their knowledge from the experiments at Gerlafingen. Durrer equated his work with the work of Schwarz and Miles which was clearly considered by the Patent Office. Thus, even if the patentees should have called the attention to the Patent Office to the work of Durrer and Hellbruegge, any failure to do so was inconsequential.

As to defendant's argument that the patentees misrepresented to the Patent Office that the Schwarz process was inoperable, there is no validity. The record convincingly supports the conclusion that the Schwarz process was inoperable. Furthermore, the record clearly shows that the Schwarz process was called to the attention of the Patent Office.

[84] As to any objection of the patentees to emphasize the importance of the Cuscoleca patent in the Patent Office, the record is clear that the latter office was fully aware of the Cuscoleca patent and that the Suess and Cuscoleca patents are addressed to different inventions.

The defendant further alleges that the patentees perpetrated a fraud on the patent office when they alleged that the earlier foreign application was Austrian Appli-

cation Serial No. A 480-50 filed on January 31, 1950. It now appears that an earlier Suess application, Swiss patent No. 283,825 (DX-23A) was filed four days earlier on January 27, 1950.

I take judicial notice of the fact that January 27, 1950, was on a Friday, and January 31, 1950 was on a Tuesday. Thus, the Austrian application was filed only two business days after the Swiss application. Defendant has failed to demonstrate any sinister intentions on the part of the patentees in making this erroneous statement.

[85] It is provided in 35 U.S.C. § 102(d) that an applicant shall be entitled to a patent unless:

> "(d) the invention was first patented or caused to be patened by the applicant or his legal representatives or assigns in a foreign country prior to the date of the application for patent in this country or an application filed more than twelve months before the filing of the application in the United States."

It should be observed that the Swiss application was filed on January 27, 1950, less than twelve months prior to the application here, and the Swiss patent issued October 16, 1952, a year and a half after the Suess application was filed here (DX-23A).

As counsel for the plaintiffs conceded, at worst the patentees would be deprived of the advantages of the earlier European filing date under Section 119.

Defendant also challenges the credibility of the Rinesch and Hauttmann affidavits. This argument is unsupported by the record and without merit. Furthermore, misrepresentations are not material unless they relate to the condition of patentability. *Trio Process Corporation* v. *L. Goldstein & Sons, Inc., supra.*

[86] It therefore appears that defendant's allegations of fraud are without merit.

2. Alleged Misuse of the Patent After Its Issuance

Defendant alleges that the plaintiffs misused the Suess and Cuscoleca patents in initiating lawsuits. Once the Suess patent was issued, Cuscoleca was withdrawn as the basis of the *McLouth* litigation, and it would appear that all subsequent litigation relied on Suess.

As to the allegations that the plaintiffs made false statements concerning the Suess process, and that by withholding information improperly coerced licensing agreements, there are no supports in the record.

While several other minimal allegations are made, they are likewise unsupported by the record and without merit.

3. Attempts To Prevent Relevant Evidence from Coming Before the Court

Defendant alleges that the plaintiffs attempted to prevent vital information from coming before the Court, by attempting to prevent Dr. Durrer from being subpoenaed. When Dr. Durrer was served with a subpoena, he appeared before the Honorable Wallace S. Gourley of this Court in an effort to have [87] that subpoena quashed (DX-269). Judge Gourley quashed the subpoena and Dr. Durrer voluntarily appeared at the McLouth trial. The charge of attempting to withhold this critical testimony, likewise, is not supported by the record.

From all of the foregoing, I conclude as a matter of law that the Suess et al. Patent No. 2,800,631 is valid.

1. *Antitrust Defenses.*

The defendant, J & L, contends that through their agreements and actions the plaintiffs have conspired to violate Sections 1 and 2 of the Sherman Antitrust Act, 15 U.S.C. In its Consolidated and Amended Answers and Counterclaims, the defendant argues that during or prior to May

1952, VOEST, BOT OAMG and Kaiser conspired to create an unlawful monopoly, patent pool, and cartel to exact unlawful tribute in interstate commerce for all top blown methods of steel refining and equipment used therein; that improvements made to the refining process by VOEST and OAMG were at best narrow improvements over Durrer, Hellbruegge, Schwarz and Miles; that the four conspirators created the patent pool to gain rewards greater than their individual patents would justify and to exact tribute on all steel manufactured by the top blowing oxygen method; that the conspirators published the fact [88] that "the most important group of patents . . ." had been acquired ". . . so that it can be avoided, that one single patent holder is played off against another . . ."; that they had further published that BOT had created a "large patent pool" including patents of Schwarz, Miles and VOEST, and that VOEST had acquired shares of the BOT joint-stock company; that during or prior to May, 1954, the conspirators entered into an agreement with Mannesmann, granting it a license under the Schwarz patent in return for licensing rights for BOT under Mannesmann's present and future knowhow and patents and a pledge that Mannesmann would not contemplate or operate a steel plant in the United States; that the conspirators, in furtherance of their plan, have entered into numerous agreements with patent holders worldwide so as to stifle competition and concentrate their control; that in furtherance of their conspiracy the conspirators perpetrated a series of frauds on the United States Patent Office, thereby procuring patents (including the patent in suit); and that the conspiracy has not been abandoned nor terminated, but continues to exist in restraint of trade in [89] interstate commerce.

Upon analysis of the charges and the record, I conclude that there is no basis for the defendant's contentions.

Concisely stated, the defendant argues that by gaining the rights to many BOF patents (Suess, Walker, Cuscole-

ca), the plaintiffs had the power to control the price of steel made by BOF methods; that their agreement with Kaiser shows the purpose of the parties to gain control of the industry in the United States; that they forced potential users of BOF systems to enter into royalty agreements by litigation, or threats thereof, based upon infringement of one or the other patent; and that they thus stifled natural competition between patent owners and gained greater rewards than would naturally flow from the Constitutional guarantee of patent monopoly.

In searching the record I find that there was very little testimony or evidence directed to the antitrust allegations. Nonetheless, I have studied the entire transcript to ascertain whether the charges are substantiated. They are not.

[90] It is apparent that the plaintiffs did gain the rights to a package of patents which dealt with the refining of steel through top blowing of pure oxygen. Cross licensing or exchange of patents, however, is not per se illegal. *McCullough Tool Co.* v. *Well Surveys, Inc.*, 395 F.2d 230 (1968), *cert. den.* 393 U.S. 925 (1968); *Cole* v. *Hughes Tool Co.*, 215 F.2d 924, 935, C.A. 10, 19—. Thus I must determine whether the arrangement in this case so dominated the relevant market or could do so as to be violative of antitrust provisions.

The "relevant market" has been defined as "the part of trade or commerce which is monopolized or attempted to be monopolized," *United States* v. *DuPont & Co.*, 351 U.S. 377, 394, ff (1956). Numerous cases have held, however, that when two or more processes can be used to produce identical or interchangeable products, and these have been bought in the market on such a basis, the relevant market encompasses the totality of the materials produced by these various methods. *United States* v. *Aluminum Co. of America*, 148 F.2d 416, 424-425, C.A. 2, 1945.

[91] In the case at bar, as has been thoroughly documented above, the Suess and other BOF processes constituted only a few of the methods by which steel was being produced commercially. At the time of Suess' introduction on the market, the open hearth, electric and Bessemer methods were all found in use. Admittedly the BOF gained immediate acceptance throughout much of the industry because of its low cost, high efficiency, and quality of product. But these factors certainly are not a basis upon which antitrust violations may be determined. *U.S.* v. *Aluminum Co. of America,* 44 F.Supp. 97 (D.C.N.Y.) rev. other grounds 148 F.2d 416, C.A. 2, 1945.

The Supreme Court has held that the interchange of patent rights ". . . is frequently necessary if technical advancement is not to be blocked by threatened litigation." *Standard Oil Co.* v. *United States,* 283 U.S. 163, 171 (1931). The case at bar is exemplary. The Suess, Cuscoleca and other patents contain obvious similarities which could presumably form a basis for continuous infringement litigation. Indeed, the publications of plaintiffs, which defendants cite as proof of the conspiratorial intent, tend instead to show an attempt at self protection. To impute a more sinister motive in this case would require a predispositive inclination toward guilt which I cannot assume.

[92] Even if the royalties charged by the plaintiffs are considered onerous (a question which I will not entertain here), such an allegation standing alone is without legal significance. "Unless the industry is dominated, or interstate commerce directly restrained, the Sherman Act does not require cross licensing patentees to license at reasonable rates others engaged in interstate commerce." *Standard Oil Co.* v. *United States, supra,* at page 172.

Defendant's reliance upon BOT's agreement with Kaiser as proof of the intent to create a monopoly is without merit. Study of the record does disclose extremely broad def-

initions of "Oxygen Metal Process," "Patent Rights," and "Converter."

> "(A). Patent Rights" shall mean all process, equipment designs for equipment, products, compositions of matter, formulae, technical information and know-how relating to or in any way connected with the Oxygen Metal Process, as hereinafter defined, including all inventions, ideas or discoveries in connection therewith disclosed or claimed in any United States patent applications and/or **[93]** United States patents, all as more particularly described in Exhibit "A" attached hereto and by this reference incorporated herein and made a part hereof.
>
> (B) "Oxygen Metal Process" shall mean a process for the production of metal products as the result of treatment of molten metal with oxygen in a converter as herein defined and comprising but not limited to the oxygen process for the manufacture of steel as practiced at Linz and Donawitz, Austria, but not limited to the production of ferrous metal products.
>
> (C) "Converter" shall mean the reaction vessel in which the Oxygen Metal Process is conducted, including the oxygen injection or applying apparatus appurtenant thereto." (PX-7)

Despite the apparent vagueness, however, the inclusion of "Exhibit A," a list of patents and applications claimed by plaintiffs, serves to delineate the processes which are covered. As with the formulation of patent language itself, the writers of agreements such as this generally strive for broadness, thus **[94]** staking out the greatest possible area of coverage. Such goals, however, are not automatically an indication of antitrust inclinations. Certainly the agreement does not cover the open hearth or Bessemer processes, both of which can use pure oxygen, although they could presumably fit within the definitions. Thus from the rec-

ord I can imply nothing more than that the plaintiffs were attempting to regulate all aspects of the patented processes which were theirs by law, granted to them by our Constitution.

[95] Breach of Contract and Patent Infringement

Having reached the conclusion that the patent in suit is valid, I must now direct my attention to two questions, the first of which is whether or not by virtue of its operations at Aliquippa, the defendant has breached its contract with Kaiser (PX-7A). The second question is whether or not by virtue of the operation of two basic oxygen steel-making converters at its Cleveland Plant, the defendant has infringed Suess et al. patent No. 2,800,631 (PX-1).

On February 4, 1956, Kaiser and J & L entered into a licensing agreement whereby Kaiser granted to J & L a non-exclusive license under certain specified patent rights to produce and sell steel from molten ferrous metal utilizing the equipment and methods of the L-D process at converters to be constructed at Aliquippa. Among the patents covered in the license agreement was application Serial No. 547,233, filed November 16, 1955, on which Suess et al. patent No. 2,800,631 issued. Pursuant to the license agreement, J & L covenanted to pay Kaiser royalties in accordance with an established schedule (PX-7A, Exhibit B). That schedule provides that J & L would pay Kaiser a total royalty of $709,750 of which $285,000 was to be paid "upon commencement of operation" of J & L's first **[96]** converter at Aliquippa. In addition, J & L agreed to pay $42,375 "annually thereafter for ten (10) consecutive years payable on each anniversary date of such commencement of operations." Unpaid balances were to bear interest at the rate of 4% per year "payable at the time of each annual installment payment." It was provided in the license agreement that notwithstanding any other provisions of the agreement, the obligation to tender the ten an-

nual royalty payments would not accrue, until J & L engaged in the commercial practice of the oxygen steelmaking process or commercial operation of the converter "within the scope of the valid claim of an unexpired United States patent issuing on any of the Patent Rights." Initially upon commencement of operations, J & L refused to make the $285,000 payment. However, this payment was finally made, but no additional royalty payments were ever forthcoming (PX-472, pp. 1203-04). For this reason, Civil Action No. 61-551 was filed by Kaiser against J & L to compel contractual payments.[23]

At its Cleveland plant, J & L added two additional converters without license from Kaiser. As the evidence shows and as J & L has admitted, the same process is practiced in the [97] converters at Cleveland as in the converters at Aliquippa (PX-84, p. 15). Because of the unlicensed operation of the Cleveland converters, Kaiser and the other plaintiffs filed Civil Action No. 62-272 to recover damages and enjoin further alleged unlawful infringement by J & L.

Thus, the issues presented which must be resolved require determinations of whether or not the operation of J & L at its Aliquippa Plant falls "within the scope of a valid claim of an unexpired United States patent issuing upon any of the Patent Rights." The other principal issue for determination is whether or not by virtue of the operation of the converters at its Cleveland Mill, J & L is operating within the scope of claims 1 or 2 of the patent in suit. That is, whether or not by virtue of its operations at Cleveland, J & L has infringed Patent No. 2,800,631.

The plaintiff in the contract action alleges that the defendant is foreclosed from attacking the validity of the patent under the terms of the license agreement and under existing law. It is provided in the license agreement

[23] It should be observed that in the contract action, the only plaintiff is Kaiser Industries Corporation.

(PX-7A, Art. G) that "LICENSEE SHALL NOT AT ANY TIME DURING THE TERM OF THIS AGREEMENT DIRECTLY OR INDIRECTLY CONTEST OR DENY THE VALIDITY THEREOF OR THE RIGHT AND TITLE OF LICENSOR THEREIN." [98] *In Automatic Radio Manufacturing Co., Inc.* v. *Hazeltine Research, Inc.*, 339 U.S. 827, 836 (1950) it was stated:

> "The general rule is that the licensee under a patent license agreement may not challenge the validity of the licensed patent in suit for royalties due under the contract. *United States* v. *Harvey Steel Co.*, 196 U.S. 310."

However, in 1969 the Supreme Court changed this general rule. *Lear, Inc.* v. *Adkins*, 395 U.S. 653 (1969). And thus the plaintiffs' allegation that the defendant is foreclosed from attacking the validity of the patent is without merit. By way of defense J & L alleges that because the patent was secured in violation of the antitrust laws, the plaintiff is guilty of unclean hands, and that therefore this covenant is unenforceable. In support of this position the defendant relies on several cases which are totally inapplicable here.[24] The basis for determining that these cases are inapplicable arises from the fact that in those cases the license agreements involved price fixing provision which were *per se* antitrust violations. As the Court in *Automatic Radio Manufacturing Co., Inc.* v. *Hazeltine Research, Inc., supra*, stated at page 836:

> "The general principle of the invalidity of price fixing agreements may be invoked by the licensee of what purport to be valid patents to show in a suit for royalties that the patents are invalid. . . . There is no showing that the licensing agreement here or the practices under it were a misuse of patents or contrary to public policy. . . . The general rule applies, and peti-

[24] The cases the deefndant relies upon are *MacGregor* v. *Westinghouse Electric & Manufacturing Co.*, 329 U.S. 402 (1947); *Katzinger Co.* v. *Chicago Metallic Manufacturing Co.*, 329 U.S. 394 (1947); *Sola Electric Co.* v. *Jefferson Electric Co.*, 317 U.S. 173 (1942).

tioner may not, in this suit, challenge the validity of the licensed patents."

[99] As has been discussed previously under the issue of patent validity, the defendant has failed to demonstrate and the record does not support a determination that the plaintiffs violated the antitrust laws. For this reason, the estoppel raised by the defendant is clearly inapplicable.

The question thus becomes one of determining whether or not J & L at its operations at Aliquippa and at Cleveland falls within the scope of the claims of the Suess et al. patent. That is, is the operation at Aliquippa "within the scope of a valid claim of an unexpired United States Patent issuing upon any of the Patent Rights" or, is the operation at Cleveland within the scope of Claim 1 or Claim 2 of the patent in suit? Defendant has admitted that there is no significant difference between its operation at Aliquippa and those at Cleveland (PX-484, p. 15). For this reason, and in the interest of conserving time and avoiding repetition one analysis of the J & L operations at Aliquippa and Cleveland will be made in an effort to determine whether or not they infringe upon the claims of the Suess et al. patent.

In order to install the new furnaces at its Aliquippa Plant, J & L obtained the services of Kaiser. To Kaiser fell the job of engineering and construction, and the training of J & L operating personel (R. 3221-26). Before commencement of operations at Aliquippa, Mr. Edwards the original operating [100] superintendent of the Aliquippa L-D Plant went to both Linz, Austria, and Donawitz, Austria, to study actual operations of an L-D plant (R. 3224-25; PX-469, pp. 9-10). Edwards and W. D. Smith, the original general foreman at Aliquippa, visited the Dofasco plant at Hamilton, Ontario which was operated under license from BOT and two turn foremen and two melters from Aliquippa were sent to Dofasco for at least one week

to observe "and to get familiar with the operations." (PX-469, pp. 10-11). Mr. Prince who helped prepare an operating manual spent four months in Linz and Donawitz, Austria, studying all phases of the operation of the process (R. 3226). Immediately upon returning from Austria, Prince went to Aliquippa to assist in the completion of the plant and in the initial operations of the plant (R. 3221). Together with others, Prince gave classroom and in-plant instruction to the J & L operating personnel (R. 3222-23; PX-469, p. 13). In addition, Kaiser made arrangements for three Austrians with lengthy experience operating the L-D process to be present at Aliquippa before and during the initial operations of the plant (R. 3223; PX-469, pp. 14-16).

The Aliquippa Plant commenced operation November 11, 1957 (R. 3222; PX-469, p. 6). From that time through the spring of 1958, Kaiser personnel maintained close contact with the Aliquippa operations (R. 3222; 3954-54; 3996-97; 4005-06; PX-469, p. 38; DX-203, p. 326).
[101]

The Defendant Does Not Use the Deep Penetration of the Schwarz-Miles Prior Art

The main defense by J & L was that it was practicing the deep penetration in accordance with the teachings of Schwarz. The plaintiff, however, produced witnesses to show that J & L was not practicing the deep penetration as advocated by Schwarz.

[102] When Mr. Prince visited Aliquippa on the occasion of the plaintiffs' inspection in February, 1966, he compared the operations after start-up with the then existing operation and stated (R. 3477):

> "The operation at Aliquippa after the start-up and in the early days when I spent so much time there were essentially the same as being conducted now . . .

> The L-D process was being carried out at Cleveland during the inspection and at Aliquippa during the 1966 inspection, and this same process was the one which was started in Aliquippa in . . . November of 1957."

To a large extent the testimony of Mr. Prince is very similar to that of the other experts called in this trial. When asked what the patent teaches him as one skilled in the art as to the principles of the process described therein, Mr. Prince replied:

> "It teaches me how to refine molten impure iron in the presence of a slag and in a refractory lined vessel by means of blowing with oxygen.
>
> It tells me that the stream of oxygen must be directed vertically downwardly at substantially the center of the bath so that it goes through the slag and engages with the metal of the bath.
>
> By doing this, part of the reactions take place with part of the iron of the bath and with the impurities in the molten charge, and this takes place without deep penetration and in the high temperature localized reaction zone, which is spaced away from the sidewalls and the bottom and in the upper regions of the bath.
>
> In achieving this localized reaction zone, a circulation of the liquid bath is induced and those parts of the molten charge which are away **[103]** from this localized reaction zone are brought to it and oxygen reacts with them in this high temperature reaction zone; this all taking place in a central position in the upper regions of the bath whereby there is minimum damage to the refractory lining at the walls or at the bottom." (R. 3478).

When asked whether or not the teachings of the patent were actually employed by J & L at its basic oxygen plant at Aliquippa and Cleveland, Mr. Prince answered in the affirmative (R. 3481). Dr. Chipman's testimony was substantially identical (R. 532-33; 570-72).

Mr. Prince also testified that the avoidance of material agitation in the bath by the oxygen stream meant "avoidance of deep penetration with the attendance of some agitation from the oxygen stream." (R. 3610)

Both Dr. Chipman (R. 563-64; 571) and Mr. Prince (R. 3266-67; 3472-77, 3478, 3481) testified that J & L avoids deep penetration in its regular operations at Cleveland and Aliquippa. In February 1966, Mr. Prince attended an inspection of the J & L works at Aliquippa and Cleveland (R. 3450, 3454, 3472). PX-328 is a summary of the observations made at Aliquippa, and PX-329 is a summary tabulation of data taken during the Cleveland inspection (R. 3450-51, 3454-59). Specifically Mr. Prince stated (R. 3472-74):

> "My conclusion of viewing the operations and the work that I have been discussing is that there is no deep penetration of the bath; that the indent which develops is of the order as shown in PX-328 and PX-329, that the localized reaction zone is in the upper regions of the bath;
>
> [104] That blowing is conducted not to penetrate deeply and damage the bottom, and so have difficulty in phosphorus removal; nor is it done to blow on the surface and cause an excessive slopping condition, but so that the localized reaction zone is developed in the upper regions of the bath which is spaced from the sidewalls and bottom so that injury to the refractory lining is avoided, and so that a circulatory movement is induced, by which those parts of the liquid bath away from this high-temperature localized zone are brought to it and undergo reactions with the oxygen of the jet, and all in such a way that there is minimum injury to the refractory lining;
>
> In every case in J & L's Aliquippa Plant and their other LD plants, the oxygen is blown by a vertically-held lance, and the oxygen is directed downward onto the bath vertically, and always in the presence of the slag, so that the oxygen goes through the slag and reacts with the metal.

Q. . . . In your opinion, is the operation conducted at Cleveland and the operation at Aliquippa conducted so as to provide an appropriate slag which will enable the removal of phosphorus to low levels?

A. Yes. The operation of the lance and the oxygen flow is such as to give an early formation of fluid slag."

Dr. Chipman in his testimony stated that at Aliquippa and Cleveland (R. 821), "the result of the blow was a good low-phosphorus steel, and this tells me again that the blowing was not deep, that it was satisfactory."

In order to demonstratively show that deep penetration is avoided by J & L, the plaintiffs presented three demonstrations.

[105]

The Demonstrations and Tests—Avoidance of Deep Penetration

The first demonstration was designed to show that the operational process conducted at Aliquippa and Cleveland avoids deep penetration. The second demonstration was designed to show that the depth of penetration could be determined from the jet characteristics, and Dr. Kemper indicated that the penetration actually obtained was not deep especially in comparison to the total bath depth. The third demonstration consisted of a series of penetration depth studies.

As has been thoroughly discussed previously, one of the major operational characteristics of the Suess process is that it avoids undue wear on the refractory. Dr. Chipman stated that in reviewing the J & L operations, (R. 821):

"Basically, I found no undue erosive effects on the furnace bottom. That is, inspecting the bottom when the vessel is turned down for pouring, one can see the part of the bottom which was immediately under the lance during the blowing, and there was no inordinate amount of refractory wear that was visible at this point."

Mr. Prince testified that he made observations at both Aliquippa and Cleveland in February in 1968. Specifically, Mr. Prince stated (R. 3476):

> "... I was particularly looking to see if there was any localized wear in a position equivalent to the vertical lance axis, and there was none of a character which would suggest to me that deep blowing was being done ..."

Mr. W. D. Smith of J & L likewise indicated that the bottom wear rate was comparatively low (PX-479, pp. 123-24).

[106] A second operational characteristic which can be observed and which shows that J & L does not employ a deeply penetrating jet is the control of the composition of the metal bath and the slag which J & L achieves. Dr. Chipman stated (R. 821):

> "The other criterion that I used is with regard to phosphorus. There was apparently no difficulty in meeting a good phosphorus specification in the metal. The result of the blow was a good low-phosphorus steel, and this tells me again that the blowing was not deep, that it was satisfactory."

This testimony of Dr. Chipman's was in relation to both the Aliquippa and Cleveland works. Mr. Smith testified that the phosphorus at the end of the blow is normally around .013% and that on medium and high carbon grades it is about .018 to .20% (PX-469, pp. 162-68). At an inspection conducted by the plaintiffs at the Aliquippa works, the average phosphorus content of the finished steel was found to be 0.0135% (PX-404). This low phosphorus content in the finished steel product is highly indicative of the fact that the defendant's operations avoid deep penetration.[35]

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[35] As has been thoroughly discussed, *supra*, in order to insure adequate phosphorus removal, it is necessary to secure an early fluid

A number of tests were conducted in order to demonstrate [107] that J & L's operations avoid deep penetration of the jet into the metal bath. PX-455 demonstrates the result of utilizing the single hole nozzle and reveals that the depth of penetration is approximately five inches in a bath of 37 inches, or only 13% of the bath's depth. The same chart also shows that with the two-hole nozzle in regular operation, the depth of penetration is only four inches in a bath of 37 inches depth, or approximately 11% of the bath's depth. Dr. Kemper conducted a series of tests concerning depth of penetration and impingement. His testimony concerning these tests appears at R. 1924-2569.

Dr. Kemper testified that, "the properties of the jet at the surface which will determine the depth of indent are the density and the velocity of the jet as it approaches the surface." (R. 1925). However, Dr. Kemper went on to explain that "the depth of the indent . . . is equal to that dynamic pressure divided by the weight density of the liquid." (R. 1962)[28]

In order to demonstrate depth of penetration, Dr. Kemper and others conducted a variety of tests.

The electric probe tests (PX-38B) were conducted at Linz late in 1966 and were described in detail by Mr. Wallner (R. 1280-1306), Mr. Oberhauser (R. 1608-17) and Mr. Truppe (R. 1757-60). During these tests, an electric probe was [108] attached directly below the bottom of the lance, and immersed in the bath at depths varying from 20-200 mm. An electric current passing through the probe was interrupted when the probe became exposed, i.e., when the probe was above the bottom of the indent. With a constant

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slag. The slag in turn is secured by the creation of a localized reaction zone which avoids deep penetration.

[28] Dynamic or impact pressure is the difference between the stagnation pressure and the static pressure, i.e., that pressure due to the motion of the fluid (R. 1961-62; PX-429).

lance height of 700 mm., and at a pressure of 12 atmospheres the depth of penetration of the oxygen jet was approximately 50 mm. (PX-38B). That the probe itself does not reduce the depth of indent was verified by Dr. Kemper (PX-145). Based on Dr. Kemper's calculation, it was determined that with a lance height of 700 mm. at 12 atmospheres, the depth of penetration was about 90 mm. (PX-446).

Another series of tests, the Linz comb tests were carried out in 1950 using a 50 ton ladle, and following the Suess teachings in order to obtain information regarding depth of penetration in a vessel more comparable to that employed in commercial operations. In these tests steel rods with projecting teeth were immersed at varying depths in the molten metal bath. The comb was pulled horizontally across the axis of the oxygen jet during the course of a blow. The comb was then removed and observed to determine whether or not any teeth had been destroyed.

Nine comb tests were conducted in October 1960 (PX-31A and B). Similar tests were conducted in May and September 1960 (PX-32-1, Annexes 15-17; PX-32-97A; PX-34B). Dr. Hauttmann explained that these tests "were intended to find out what goes on in the bath at different distances from the bath surface, "and that the demonstration was to be made by observing the [109] condition of the combs after the tests (PX-424, pp. 2193-94). The tests were conducted with a 1.375 inch nozzle at a height of 1050 mm. (about 42 inches) at a pressure of about 100 psig. (7 atmospheres).

The results of these tests show that of those teeth which were 0 to 125 mm. below the bath surface, 50 percent were removed; of those teeth which were between 125 and 250 mm. below the bath surface, 33% of the teeth were removed; and of those teeth at a distance greater than 250 mm. below the bath surface, none was removed. Based on these tests, Dr. Hauttmann concluded that the oxygen jet

does not penetrate beyond 230 mm. (about 9 inches) (PX-424, pp. 2205-07). The Linz tests thus established that in practicing the Suess process, the oxygen jet does not penetrate deeply.

Dr. Kemper made extensive tests on models of the J & L nozzles in order to determine the depth of penetration at J & L (R. 2444-50; PX-44). From his tests, Dr. Kemper was able to conclude that the depth of penetration at defendant's Aliquippa operations, employing a single-hole nozzle at a height of 80 inches and a flow rate of 6,500 CFM is approximately 5 inches, and that for the two-hole nozzle at 60 inches and 6,500 CFM, the depth of penetration was a little over four inches [110] (R. 2475-77; PX-449; PX-450; PX-451).

Dr. Kemper further explained that the presence of slag would reduce the depth of penetration to approximately one-half that shown in PX-449, PX-450 and PX-451 (R. 2483-89).

Mr. Prince also made tabulations from the operations at Aliquippa (PX-328). He observed that the depth of penetration during each blow varied between 5 and 6 inches. (R. 3451).

The defendant contends that it was practicing the teachings of Miles at its plants at Aliquippa and Cleveland. In support of this contention defendant conducted a series of tests at Charleston, South Carolina in December 1966 to demonstrate the operativeness and practicality of the prior art which J & L alleges it practices. While four tests were made, the defendant only relies on tests 3 and 4 and the relevant exhibits, DX-212 and DX-213.

Dr. George Cunnigham Smith, a research associate at J & L conducted these tests (R. 4218). The results of his tests appear in DX-169. Dr. Smith stated that heat number 3 was conducted according to the teachings of Miles (R. 4228-32, 4271-72) and that heat number 4 was conducted

according to the teachings of the Rinesch affidavit (R. 4238-40; DX-188). From the steel produced in these tests, pencil ferrules were made (R. 4262; DX-171, DX-172, DX-189).

[111] While the witness originally testified that an attempt was made to follow the instructions of Miles, on cross-examination Dr. Smith admitted that Miles' teachings could not be used in small furnaces. Furthermore, the witness indicated that the Miles' teachings would be impractical at the Aliquippa and Cleveland works because the heat would be long and drawn out and the rate of oxygen supply would be small compared to the hot metal charge. The present blowing time at Cleveland is 20-25 minutes whereas if Miles were practiced the blow would require 100 times longer, and would be commercially intolerable (R.4393). The remainder of the cross-examination is convincing of the fact that the teachings of Miles were not adhered to at Charleston (R.4394-4452).

Test number 4 purported to follow the explanation contained in the Rinesch affidavit which attempted to explain the June 17, 1949 Linz tests. The defendant alleges that good steel was produced during this test while the Rinesch affidavit alleges that the June 17 tests resulted in failure.

It is imperative to recognize while examining DX-212 and DX-213, that absolute depth of penetration is a meaningless term. As Dr. Smith admitted, depth of penetration can only be meaningful in relationship to total bath depth (R.4477-4484). Furthermore, as counsel for the plaintiffs stated at final argument (FA pp. 218-19):

> [112] "The Miles bath depth, of course has to be calculated from the percent penetration and penetration figures which are set forth in that table. But you find that Miles at 6.9 inches is 43 percent of the bath depth. The patentees in their following of Miles had 43 percent, but the Suess et al. patent teaches only 33 percent penetration. When absolute penetration is considered without taking into account whether the bath is 10 inches or 50 inches in depth, one can conclude that the

penetration in Suess et al. is greater than that taught by Miles. But the comparison is obviously improper. And when the penetration is placed in proper context, it is clear that Miles penetration is substantially greater than that taught by Suess et al. Actually, the penetration of Miles is one third greater than the penetration taught by Suess."

Plaintiffs' counsel further clarified this matter (FA p. 219):

". . . It is clearly shown in DX-212 . . . that those penetrations at Aliquippa are on the order of ten to 13 percent of the bath depth. That shows penetrations, penetrations that are given there, as 6.6½ inches up to 8 and 9 inches for Cleveland representing only approximately 9 to 13 percent of the bath depth, whereas Miles is 6.9 inches and is 43 percent of the bath depth . . . 9 percent is a far cry from 43 percent . . . and at Aliquippa they penetrate to about 10 percent of the bath depth as contrasted with our assumed Miles penetration which is about 43 percent."

This explanation may be illustrated as follows:

Operation	Bath Depth	Penetration	% Penetration
Miles	16 inches	6.9 inches	43%
The Patentees following Miles	19.6 inches	8.2 inches	43%
Suess et al Patent	39.4 inches	12.5-13.0 inches	33%
Aliquippa Single Hole Nozzle	38 inches	5.0 inches	13%
Aliquippa Two Hole Nozzle	38 inches	4.0 inches	10.5%
Cleveland M16C Nozzle	68 inches	8.0 inches	12%
Cleveland M18C Nozzle	78 inches	9.0 inches	13%

(R.4481-85).

[113] While counsel for the defendant argued that the steel produced at Charleston was utilized to manufacture pencil ferrules, nothing in the record indicates that this steel was comparable in quality to open hearth steel, nor has there been a showing by J & L that the steel produced at Charleston was suitable for anything more than this limited purpose.

Additionally, the parameters used by Dr. Smith were limited to lance height, nozzle size, and blowing pressure. As has been expounded elsewhere, the Suess process was far more detailed. Consequently, I conclude that the Charleston tests do not prove the operativeness or the practicability of the prior art, or that J & L was following the teachings of Miles. Furthermore, because the operations at Aliquippa do not penetrate below 13% of the bath depth, and most probably the average penetration is in the range of 6 to 7 percent, the conclusion thus is inescapable that at its Aliquippa operations, J & L does not penetrate deeply.

In reviewing the operations of J & L at its Cleveland works, Dr. Kemper prepared two charts (PX-450 and 451; R.2478), which demonstrated that using its 3-hole nozzle at 13,500 CFM and at a lance height of 50 inches, J & L produces an indent of 6 inches. Furthermore, when J & L employs the same type nozzle at a pressure of 17,500 CFM, an indent of 8 inches is produced (R.2480). Using a single-hole nozzle operating at a height of [114] 80 inches with a pressure of 73 pounds per square inch gauge, J & L produces a penetration of between 9 and 10 inches (R.2480).

Dr. Kemper testified that by employing the graph shown in PX-450 one would be able to accurately predict the depth of penetration of J & L's operation at Cleveland (R.2481). However, he added that all these figures ignored the presence of slag so as to parallel the Linz electric probe tests (R.2483). Accordingly, we also determine that at its Cleveland operations, J & L does not penetrate deeply.

Tests and Demonstrations—Localized Reaction Zone

Considerable testimony was presented concerning the localized reaction zone which the Suess patent teaches. After presenting testimony concerning the execution of a localized reaction zone in the Suess process (R.269-285), Dr. Chipman discussed the operations of J & L:

> "Now, Doctor, you spoke earlier about the hot spot or localized reaction zone. I wish you would tell us specifically whether in your belief, in the J & L operations which you have observed at Aliquippa and at Cleveland there is this localized reaction zone or hot spot.
>
> A. Yes, I believe there is a reaction zone or highly heated region in the area where the jet comes into contact and engages the metal.
>
> Q. And that, as you have indicated, would be spaced from the refractories; namely, the side-walls and the bottom wall?
>
> [115] A. Yes. In all cases that I have observed, the jet is positioned centrally and the hot region, therefore, is developed at a distance from the refractory walls so as to inflict the least damage upon the refractories." (R.290-91).

When asked whether the oxygen-iron contact occurs in J & L's operation in a localized reaction zone, Dr. Chipman again answered affirmatively (R.571-72).

Mr. Prince also testified that at its Aliquippa and Cleveland works J & L had the "formation of a localized reaction zone spaced from the refractory walls of the vessel somewhere in the upper regions of the bath" (R.3265). He continued (R.3265-66):

> "The progress of the heat was such that the unrefined portions of the bath were brought to the central localized reaction zone, which was at a very high temperature, and refined. And, the localized reaction zone was such that there was no damage—excessive damages—to the bottom. And it was spaced from the walls so that

there was no excessive damage to the walls; just the normal wear of the vessel." (R.3265-66).

Dr. Elliott reviewed the Linz thermocouple tests which were designed to demonstrate the existence of a localized reaction zone. He explained (PX-504, p. 6259):

> "One of the thermocouples was located essentially directly under the area of impingement of the oxygen jet on the bath. The thermocouple indicated a very rapid rise in temperature, and it was quickly destroyed. This indicates the existence of this hot reaction region.
>
> [116] The other thermocouples located further away [from the nozzle] were not destroyed. Their temperatures did not rise rapidly."

In the thermocouple tests four thermocouples were located near the axis of the lance (R.1190-94; PX-32-1, Annex 19; PX-170). The temperature of the thermocouple nearest the lance axis rose rapidly and destroyed the instrument (R.1211-13, 1215-18). The other thermocouples experienced more gradual heat rises (R.1211-15). This test enabled Mr. Wallner to conclude that the localized reaction zone exists below the oxygen jet as it impinges on the bath (R. 1218-19). Dr. Hauttmann drew the same conclusion from the tests. (PX-424, p. 2176).

Further proof of the existence of a localized reaction zone was gained from the work of Messrs. Wallner, Oberhauser and Truppe conducted at Linz in December 1966. Their work included utilizing a silicon "solar" cell radiation pyrometer built into the lance so that temperature measurements could be taken directly below the lance where the oxygen impinges on the bath. A thermocouple was also utilized to verify the results. As a result of these observations, it was learned that the temperature in the localized reaction center was 800 to 1000 C°. (1480 to 1800 F°.) higher than the bath temperature [117] (PX-41A and 41B; R.1222-54, 1589-1605, 1760-81).

Thus, conclusive proof of the existence of a localized reaction zone spaced a substantial distance from the refractories has been presented.

Dr. Kemper conducted a series of tests to demonstrate the size and approximate shape of the high temperature reactive zones at J & L's Aliquippa and Cleveland works (PX-452; PX-452A; PX-452B; PX-453; PX-454; PX-454A; R.2489-2512, 2534-39). From his observations, Dr. Kemper concluded that at Aliquippa the area of impingement was approximately 3 percent (R.2550-60; PX-455), and that at the Cleveland operations the indents are basically similar (R.2489-2504).

These tests demonstrate that at its operations in Cleveland and at Aliquippa, J & L produces a localized reaction zone according to the teachings of the patent in suit.

Tests and Demonstrations—Circulation

The claims of the Suess et al. patent speak of "a circulatory movement in the molten metal, which circulatory movement brings those portions of the molten metal bath which are remote from the reaction zone into the reaction zone whereby those portions are subjected to said reaction with minimum injury to the refractory lining." (col. 12, lines 24-29).

Dr. Chipman testified that circulation exists in the bath and that its primary causes is chemical reaction, especially the [118] violent evolution of carbon monoxide (R.553-54, 557-61). Both Mr. Prince and Dr. Elliott testified in a substantially similar manner (R.3479-87; PX-504, pp. 6139-44).

Evidence of the existence of circulation in the bath was presented by the experts. Dr. Chipman testified that purely physically or mechanically induced circulation would cause an upward movement in a bath (R.318-20; PX-137). Dr. Kemper demonstrated this process by blowing nitrogen on a water bath and showed that it is the viscous forces created

by the physical or mechanical action of the jet, and not the downward force of the jet which caused the circulation (PX-239, PX-240; R.2666-83).

The Linz rudder tests [27] were carried out at Linz during May, September and October 1960, July 1963 and additionally in 1966 to demonstrate the direction of circulation in an L-D converter (R.979). The rudders utilized consisted of a steel blade about 8 inches high, 12 inches long and 0.4 inches thick attached to a steel shaft (R.973-74; PX-32-1, p. 12). Through a mechanical [119] system, movement of rudder could be observed (R.944-46, 958, 971-73; PX-32-1, p. 13, Annex 10, PX-165).

The rudders were positioned at various levels in the bath, and the movement of the rudder employed to show the direction of circulation (R.1114-17; PX-167). In all these tests, the rudders in the upper half of the bath indicated a circulation toward the center—no rudder in this region of the bath ever pointed outwardly. On the other hand, the rudders in the lower portions of the bath generally turned outwardly, showing an outward circulation.

Dr. Shapiro studied the data thus collected and stated:

> ". . . I concur with your statement that the only conclusion that holds together from the evidence, from the observations, is that there is established in the steady state a toroidal circulation which is downward in the center, radially outward at the bottom, upward near the walls, and radially inward near the top of the bath." (PX-427, pp. 3865-66).

Dr. Elliott stated, that after examining the rudder test results, he would conclude, ". . . the circulation which de-

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[27] The exhibits relevant to the 1960 tests are PX-31B, 32-1, 32-2, 32-3, 32-4, 32-10, 32-82, 32-97A, 33-0, 33-3, 33-4, 33-35, 33-36, 34A, 34B, 35A-3, 51A, 51B, 52A, 164, 165, 167, 168 and 171. Those exhibits relevant to the 1963 tests are PX-161, 171, 172, 173, 179B, 180, 184, 185 and 185A. Those exhibits relevant to the 1966 tests are PX-36A to 36E, 166, 168, 168A, 168B, 168C and 174.

veloped was downward at the center, out along the bottom, upward along the walls, and back radially inward at the surface . . ." From this he concluded that "The direction of flow is incompatible with circulation caused by mechanical action of the jet." (PX-504, pp. 6265-66).

Mr. Wallner and Mr. Oberhauser drew similar conclusions [120] (PX-167, PX-175; R.1114-17, 1575-89). Mr. Prince verified these conclusions (R.3488-95; PX-334).

Dr. Kemper performed corroboratory tests in vessels in which the direction of circulation was known (R.2589-2610; PX-46, PX-46A). Dr. Kemper interpreted these tests by stating that in the upper 30 percent of the bath all rudders pointed inwardly; in the central region of the bath the flow is primarily downward; and below 80 percent of the bath depth the rudders pointed outwardly (R.2610-14). He summarized his findings as follows:

> "The over-all picture presented by these tests as compared to the tests which we conducted in which we knew the circulation was down in the center, in my opinion, can lead to no other conclusion than in these Linz tests the circulation must have been down in the center, outward along the bottom and inward at the top . . ." (R.2469).

Another test employed to show the down in center circulation was the L-shaped probe test (PX-182A and 182B). In these tests, a test rod was clamped in a triangle-shaped supporting device which could be fastened to the nozzle. After the test piece was inserted in the bath, the oxygen was blown at 8 atmospheres pressure for 20 seconds. The test piece was removed and inspected. On the basis of these tests Mr. Wallner (R.1279) and Dr. Shapiro (PX-427, pp. 3866-70) concluded that the circulation in the [121] bath was down in the center.

Dr. Hauttmann performed three "slab tests" in which steel slabs were positioned near the bottom of the vessel (about 26-28 inches below the bath surface), and the blow-

ing was conducted with a .552 inch Laval nozzle at 11 to 13 atmospheres with the lance positioned 24 to 26 inches above the bath (PX-190).

Dr. Hauttmann concluded that the dissolution marks in the center of the slab,

> "... prove that from the reaction field—that is, in the center of the bath surface—a current goes directly downwardly which is capable of causing a depression and a hole, respectively, washed out in the slab; and then, consequently, it turns outwardly towards the walls and goes upwardly along the walls, and then in the surface zone of the metal towards the center." (PX-424, pp. 2220-21).

Dr. Shapiro examined the slab test results and testified:

> "From the way in which the slab was melted by the liquid iron, we can conclude the direction of circulation.
>
> The fact that a hole is formed at the middle of the slab on the axis of the vessel shows that the direction of circulation must have been downward in the center." (PX-427, pp. 3892-93).

That this circulation is caused by chemical reaction is apparent from the alloy-addition tests. These tests were designed to demonstrate the circulation in the bath as caused by chemical reaction and not due to the mechanical or physical action of the oxygen jet. A copper bar was placed in the bottom of the test **[122]** vessel and oxygen was blown (PX-47). In those baths in which the carbon content was high, the rapid evolution of carbon monoxide caused the copper to rapidly go into solution throughout the bath. (R.469-71). However, in the low carbon baths, there was little if any copper in solution in the upper bath regions (R.472-74). From this, Dr. Chipman stated:

> "I come to the conclusion that the evolution of carbon monoxide has a very much greater influence in stirring the bath, in the agitation of the bath, in the mixing of

the bath than has the mechanical effect of the oxygen stream." (R.476)

Mr. Wallner testified in a similar manner. (R.1275).

Additional tests were conducted to determine whether adequate phosphorus removal could be obtained by the mechanical action of the oxygen jet, or only as a result of chemically induced circulation. From these tests it was determined that in low carbon baths, the phosphorus content was practically unaffected. However, in the high carbon baths, phosphorus was readily transferred to the slag (R. 478-484; PX-48 and PX-49). This again showed that the chemical reaction caused the circulation.

Dr. Kemper and Dr. Shapiro carried out experiments to demonstrate that the localized reaction zone serves to circulate or stir the bath. To depict this conclusion they carried out a series of tests involving the formation of explosive gas bubbles in a liquid bath. From the movies made of these tests, it could [123] be observed that when a vessel has a solid bottom and the enclosed liquid has a free surface, any high pressure bubble formed at the central portion of the vessel, will be driven downwardly to the bottom of the vessel (R. 2911-12; PX-249). The same was found to be true if multiple explosions occurred (R. 2871-75; PX-254).

When an oxyacetylene explosive bubble was employed, an overall circulation was established which was downward in the center (R. 2919-21; PX-256). The same was shown to be true for simultaneously exploded squibs (R.3089-3181; PX-466). From this it would appear that explosive bubbles create a circulation in the bath which is downward in the center.

Dr. Chipman explained that the rapid formation of carbon monoxide is explosive in nature as can be seen from the bath throwout (R. 252, 285-87). He testified that the bubbles which form explosively have an extremely high

potential pressure, and that the FeO is driven below the surface of the bath and reacts with carbon generating bubbles which expand rapidly. The bubbles which are formed below the surface are formed with explosive violence and exert a downward movement in the bath (R. 252, 285-87, 345-359, 360-370; PX-146 and PX-147).

As to the bath throwout, both Dr. Chipman and Dr. Elliott concluded that it was caused by the explosive chemical reaction **[124]** between the carbon and oxygen. (R. 445-74; PX-504, pp. 6268-A-69, PX-160A-160F).

Considerable evidence has been presented here which demonstrates that large quantities of carbon monoxide will evolve from the nucleating sites in the side-walls of the vessel (R. 381-98, 2721-28; PX-148, PX-461, PX-504, pp. 6270-75). These bubbles are low pressure bubbles and tend to rise due to buoyant forces, and to drag liquid along with them. This causes an upward circulation along the side walls (R. 273, 277, 381-88, 407-08, 2738-41; PX-148, PX-427, pp. 3356-59, 3361-3416).

In regard to J & L's operations Dr. Chipman testified (R. 572):

> "Q. And would you tell us also whether in those same operations the chemical reactions produce a circulatory movement in the molten metal?
>
> A. Yes.
>
> Q. And tell us whether or not in those same operations that circulatory movement of the bath brings those portions of the metal bath which are remote from the reaction zone into the reaction zone so that those portions are subjected to the reactions with minimum injury to the lining.
>
> A. Yes."

[125] Dr. Chipman testified that his descriptions of circulation aplied to the J & L converters (R. 252, 257, 263-67, 273, 278-79, 239-40, 288-90). Mr. Price also verified that the

J & L operations were substantially identical to his general descriptions of L-D processes (R. 3272-74).

Thus, it appears that the successful operations of J & L at Aliquippa and Cleveland are to a large extent due to the chemically induced down in the center circulation taught and claimed by the patentees.

In a similar manner, it was shown that in its operations at Aliquippa, J & L utilizes a lance which extends substantially vertically downwardly through the mouth of the vessel striking the central surface of the bath as instructed in the patent in suit.

J & L's Cleveland converters were placed in operation on September 13, 1961 (PX-468, p. 35).[28] While the converters are larger than those at Aliquippa (PX-468, p. 25), defendant has admitted that no significant difference exists between its operations at Aliquippa and its operations at Cleveland **[126]** (PX-484, p. 15). Dr. Chipman and Mr. Prince testified that the operations at the two plants were essentially identical (PX-484, pp. 44-45, 74-77).

Mr. Glasgow of the Cleveland works had been in charge of the Cleveland operation from its inception. He and others visited Aliquippa and studied that operation in detail (PX-468, pp. 20-22). Mr. Edwards of J & L, Aliquippa, participated in planning the Cleveland installation (PX-468, pp. 24-25). Prior to commencement of the operations at Cleveland twelve to eighteen men who were ultimately charged with the operation of the Cleveland works attended training sessions at Aliquippa (PX-468, pp. 32-33).

In addition, Mr. Glasgow and others visited a number of L-D operations prior to commencement of operations at Cleveland. (PX-468, pp. 38-42). Mr. Glasgow also testified

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[28] Relevant information concerning the Cleveland converters appears in PX-72 to PX-77, PX-331A to PX-331H, PX-126 to PX-133, PX-361, PX-363, PX-364, PX-366, PX-383, PX-386, PX-378 to PX-381, PX-468; R. 3394-3449).

that he had observed a number of plants after the Cleveland start-up and all were similar in operation to Cleveland (PX-468, pp. 43-49).

While I have carefully detailed the technological testimony presented by the plaintiffs' expert witnesses as the scientific circumstances surrounding the J & L mills, both at Aliquippa and at Cleveland, and as this testimony corroborates the fact that J & L had adopted and is using the Suess process in both its mills, I mention the fact that the defendant, except for its Charleston, South Carolina tests and Exhibits DX-212 and DX-213, produced very little evidence as scientific data on the behavior character of the reaction of oxygen and oxidizable impurities in the bath. The defendant contended that the movement in the bath was one of disorder rather than one of pattern as contended by the plaintiffs. However, the defendant offered this only as its conclusion without any credible evidence to support it. The burden was on the plaintiffs to show in these cases that the defendant at its Aliquippa and Cleveland mills adopted and was using the Suess et al. process, and this it did by its considerable scientific evidence by experts and demonstrations. The burden then shifted to the defendant to contradict the plaintiffs' evidence. By its virtually complete failure to offer similar scientific evidence, I am provided with sufficient authority to find that the defendant had no such proof, and that therefore, this considerable evidence by the plaintiffs was credible to support a finding that the defendant was making and using the Suess et al. process in violation of its agreement with the plaintiffs for the Aliquippa mill and as an infringement of the Suess et al. patent at the Cleveland mill.

[127] **Conclusion and Determination**

Accordingly, the determinations as to operations at Aliquippa are likewise applicable to operations at Cleveland,

and from all of the evidence, I conclude that J & L's operations at Aliquippa and Cleveland infringe on the claims of the Suess et al. patent.

The final determination to be made is that of damages. In the contract action the damages are readily ascertainable and an appropriate order will be entered. In the infringement action the issue of damages has not yet been tried and therefore an appropriate order will be entered assigning this matter to a United States Magistrate as a special master pursuant to Rule 53 of the Federal Rules of Civil Procedure and the Order of the United States District Court for the Western District of Pennsylvania Adopting Rules for United States Magistrates.

While this Opinion incorporates findings of fact and conclusions of law, as required by Rule 52 of the Federal Rules of Civil Procedures, pursuant to Rule 52(b) of the Federal Rules of Civil Procedure, the parties may submit further proposed findings of fact and conclusions of law, and shall also submit a proposed Order of Court, consistent with this Opinion.

January 29, 1974

[For the convenience of the Court, minor typographical errors in the foregoing opinion of the District Court have been corrected where no change in substance results on the assumption that such corrections would be made upon publication of the opinion in the Federal Reports.]

JUDGMENT OF THE DISTRICT COURT

[Entered February 19, 1974]

AND NOW, To-WIT, this 19th day of February 1974, these consolidated actions having been heard before me on the pleadings, and on proofs, briefs and arguments submitted by the parties, and after the court rendered its opinion consisting of the Opinion Compendium—Collateral Estoppel, Opinion Summary—Collateral Estoppel and the Opinion—The Jones and Laughlin Cases, and for the reasons stated therein, IT IS HEREBY ORDERED, ADJUDGED AND DECREED as follows:

1. The aforesaid Opinion Compendium—Collateral Estoppel, Opinion Summary—Collateral Estoppel, and the Opinion—The Jones and Laughlin Cases, constitute this court's findings of fact and conclusions of law pursuant to Rule 52(a) of the Federal Rules of Civil Procedure.

2. The Plea of Estoppel raised by the defendant, Jones and Laughlin, in these consolidated actions both as to the file wrapper and collateral estoppel is denied.

3. The United States Letters Patent No. 2,800,631 are valid and enforceable.

4. The License Agreement dated February 4th, 1956 between the plaintiff, Kaiser Industries Corporation (formerly Kaiser Engineers), and the defendant, Jones & Laughlin Steel Corporation, is valid and enforceable, and the defendant has breached the said agreement and is liable for damages for such breach of agreement.

5. The defendant has infringed and is infringing at its Cleveland, Ohio steel mill the claims of United States Letters Patent No. 2,800,631 and is liable for damages for such infringement of said patent.

6. Reference is hereby made to The Honorable Robert C. Mitchell, a United States Magistrate for the United States District Court for the Western District of Penn-

sylvania, who is hereby constituted as a Special Master pursuant to Rule 53 of the Federal Rules of Civil Procedure and the Act of October 17, 1968, 28 U.S.C. § 636 (b)(1), as amended, and Local United States Magistrates Rule 1C(1) of the United States District Court for the Western District of Pennsylvania, to conduct appropriate proceedings consistent with the aforesaid findings of fact and conclusions of law and this Order of Court, for the inquiring into and determining damages which may be due and owing by the defendant to the plaintiffs, or any of them, for the breach of agreement entered into between the plaintiff, Kaiser, with the defendant, J & L; and further to inquire into and determine damages which may have accrued by reason of infringement by the defendant of United States Letters Patent No. 2,800,631. Such proceedings by the special master shall be conducted in accordance with specific instructions, separately filed, and in accordance with law.

7. The defendant's counterclaims are hereby dismissed.

8. The plaintiffs shall recover from the defendant their costs in these actions to be taxed by the Clerk of Court pursuant to Federal Rule of Civil Procedure 54(d).

9. This court retains jurisdiction for the entering of such further orders as may be necessary and appropriate in these proceedings.

/s/ Louis Rosenberg
United States District Judge

ORDER OF THE DISTRICT COURT INSTRUCTING THE SPECIAL MASTER

[Entered February 19, 1974]

AND NOW, TO-WIT, this 19th day of February 1974, the following shall be specific instructions to the Special Master in the above entitled cases for the purpose of making determinations of damages pursuant to the Order of Court dated this 19th day of February 1974:

1. The Special Master shall be guided by these instructions and by Federal Rule of Civil Procedure 53.

2. The primary questions before the Special Master is, what fair compensation the plaintiffs, or any of them, may be entitled to as damages (1) because of a breach of license agreement dated February 4, 1956 between Kaiser Industries Corporation (formerly Kaiser Engineers) and Jones and Laughlin Steel Corporation; and (2) because of infringement by the defendant at its Cleveland, Ohio steel mill of United States Patent Letters No. 2,800,631, and as such is owned or licensed by the plaintiffs, or any of them.

3. Subject to the limitations stated in the Order of Court dated the 19th day of February 1974, the Special Master shall exercise the power to regulate all proceedings in every hearing before him and to do all acts and take all measures necessary or proper for the efficient performance of his duties under the Order. He shall require the production before him of evidence upon all matters embraced in the reference including the production of all books, papers, vouchers, documents and writings applicable thereto. He shall rule upon the admissibility of evidence unless otherwise directed by order of reference and shall have authority to put witnesses and parties to the actions on oath and may himself examine them. When a party so requests, the master shall make a record of the evidence offered and excluded in the same manner and

subject to the same limitations as provided in Rule 43(c) of the Federal Rules of Civil Procedure for a court sittings without a jury.

4. Compensation for damages shall mean the full and perfect equivalent in money of the losses suffered by the plaintiffs, or any of them, as prescribed in these instructions.

5. While the Special Master will be required to determine what the fair or just compensation in damages are here, such a determination cannot be arbitrary.

6. Such damages must be based upon factual findings from the evidence and arrived at fairly in accordance with the law prescribing the limitations for damages under these specific instructions.

7. The determination is to be made in the light of all the facts as divulged by the evidence and as such facts are governed by law.

8. The evidence shall at all times be legal evidence as the same has been adjudicated in the courts of law for the admission of evidence at the trial of any case, and with which a person learned in the law shall either be familiar or have available ready judicial authority on the matter.

9. The Special Master shall be the judge of the credibility of the witnesses and shall arrive at the credibility by the manner in which a witness gives his testimony, his demeanor upon the stand, the reasonableness or the unreasonableness of his testimony, his means of knowledge as to any fact about which he testifies, his interest in the case, the feeling he may have for or against any of the parties, or any circumstances tending to shed light upon the truth or falsity of such testimony.

10. The Special Master shall say what weight is to be given to the testimony of each and all the witnesses.

11. As for the expert testimony, if any should be presented, the Special Master shall evaluate the evidence of such expertise in accordance with legal principles as these define the qualifications of an expert in a particular field. Ordinarily the laws of evidence do not permit a witness to testify as to his opinions or conclusions, but an exception exists in the case of an expert witness. These are persons who have become experts in any art, science or profession and they may state their opinions as to a matter in which they are expert upon the limited evidence submitted to them and which is material to the case. They may also state the reasons for such opinions. However, the Special Master may give such weight as he deems appropriate to the evidence and opinion of any expert, or he may disregard the testimony of any such expert, if such is warranted. The Special Master shall be prepared in the first instance to rule upon whether or not a so-called expert is qualified to testify and present his opinion in this matter.

12. The fact that a person is an employee of either of the parties and yet may be expert in a particular relevant field, does not disqualify that person by reason of his employment but such may be taken into consideration by the Special Master in arriving at the weight the evidence of such a witness deserves.

13. The Special Master must perform his duty without bias or prejudice and must carefully and impartially consider all of the evidence and follow the law, whether here stated or not, in order to arrive at a just award of damages.

14. As relates to the question of compensatory damages for breach of contract, the Special Master will be guided by an interpretation of the License Agreement dated February 4th, 1956, as entered into between the plaintiff, Kaiser Industries Corporation (formerly Kaiser Engineers) and Jones and Laughlin Steel Corporation,

the defendant, with special note that the agreement provides (PX7-A, page 8): "This agreement shall be interpreted and enforced, and all questions and controversies arising hereunder, shall be resolved and adjudicated in accordance with the laws of the State of New York". The Special Master will inquire, also, into the rate of interest and periods during which the same applies and make findings accordingly.

15. The Special Master will remember that the measure of damages applicable in a breach of contract case is that the aggrieved party should be placed as nearly as possible in the same situation he would have occupied had there been no breach. Thus, the measure of compensatory damages is such sum as will compensate the injured party for the loss sustained, with the least burden to the one charged with the breach thereof, consistent with the idea of fair compensation.

16. As for any compensatory damages which may be allowed by reason of the defendant's infringement, the law provides that the plaintiff is to be fairly compensated for all damages, if any, proximately caused by the defendant's infringement.

17. The actual damages to the plaintiff caused by infringement are ordinarily most accurately determined on the basis of what from a preponderance of the evidence in the case would have been a reasonable royalty to be paid for a license to use the invention during the period of the infringement.

18. A reasonable royalty is the amount which the owner of a patent would accept, who is desirous of licensing another to use his patent in return for a royalty but who is not forced by financial need or other compulsion to do so, and the amount which a person would be willing to pay as royalty, who is desirous of obtaining a license to use the invention but who is not compelled to

do so. In other words, a reasonable royalty is the amount which free and uncompelled and uncoerced bargainers would agree upon.

19. In determining a reasonable royalty, the Special Master shall consider any evidence in the case as to the profits the defendant may have realized from the infringement, as well as any evidence in the case as to what the plaintiff may have lost because of the infringement, also any opinions in the evidence as to what would have been a reasonable royalty during the period of infringement.

20. The law permits the owner of a patent to give his opinion as to a reasonable royalty; and the testimony of a patent owner as to a reasonable royalty is to be weighted and considered the same as that of any other witness expressing an opinion as to a reasonable royalty, but if the reasons given in support of the patent-owner's opinion as to a reasonable royalty are unsound, the opinion may be rejected or given any weight it deserves.

21. In determining the issue as to damages, it must be borne in mind that the law does not permit the award of any greater sum than the monetary loss which the plaintiffs have suffered or may suffer as a proximate result of the defendant's infringement, without regard to whether the defendant has gained or lost by the infringement.

22. The question, then, in determining the issue as to damages is: What monetary loss, if any, did the owner of the patent suffer by the infringement? The answer can ordinarily be found by taking the difference between the plaintiff's financial condition after the infringement, and what his financial condition would have been if the infringement had not occurred, all as shown by a preponderance of the evidence in the case.

23. Additionally, the patent statute, 35 U.S.C. §§ 281-284 dealing with damages for infringement, must be re-

ferred to for such additional guides as may be required of the Special Master, who is a United States Magistrate and one learned in the law.

24. The damages are not to be deemed conjectural or speculative merely because they are incapable of calculation with mathematical exactness. The law requires that a reasonable quantity of information must be supplied by the one alleging damages so that fairly estimated amount of damages may be ascertained from the evidence.

/s/ Louis Rosenberg
United States District Judge

SUPREME COURT, U. S.

FILED

JUN 10 1975

MICHAEL RODAK, JR., CLERK

IN THE

Supreme Court of the United States

OCTOBER TERM, 1974

No. 74-1555

KAISER INDUSTRIES CORPORATION, *et al.*, *Petitioners*

v.

JONES & LAUGHLIN STEEL CORPORATION, *Respondent*

APPENDIX TO PETITION FOR A WRIT OF CERTIORARI TO THE UNITED STATES COURT OF APPEALS FOR THE THIRD CIRCUIT

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Specification and Claims of Suess Patent 813

KAISER INDUSTRIES CORP., *et al.*

v.

MCLOUTH STEEL CORP.

[No. 17497; decided August 2, 1968]

Before: WEICK, Chief Judge, EDWARDS and CELEBREZZE, Circuit Judges.

CELEBREZZE, Circuit Judge. Appellants filed an action in the United States District Court for the Eastern District of Michigan complaining that Appellee had infringed the Appellants' patented process for refining steel with pure oxygen. Appellee first defended by contending that a know-how agreement, for which Appellee paid $100,000 to Appellants, constituted a license to use the Appellants' process. The District Court held against the Appellee on that point, *Henry J. Kaiser Company v. McLouth Steel Corporation,* 175 F.Supp. 743 D.C. Mich. 1959), and in an interlocutory appeal was affirmed by this Court. *McLouth Steel Corporation v. Henry J. Kaiser Company,* 277 F.2d 458 (6th Cir. 1960). These rulings made it possible for the Appellee to contest the validity of the Appellants' patent at the trial on infringement[1]. The handling of the protracted trial on infringement by the District Judge was a monumental task, which he performed ably and well. After unusually long and complex litigation, involving several years of pretrial research, experimentation and discovery and over an entire calendar year of trial, the District Court concluded that the patentees were the

1. Only in exceptional circumstances can a licensee contest the validity of the patent that he is licensed to use. *Cf. Sola Electric Co. v. Jefferson Electric Co.,* 317 U.S. 173 (1942).

inventors of a process that was not anticipated by the prior art and would not have been obvious to one skilled in the art at the time of the discovery. The Court held the patent invalid, however, for the reason that the specifications did not support the claims and the claims did not measure the invention as required by 35 U.S.C. § 112 and for the further reason that the claims covered the prior art.[1a] *Kaiser v. McLouth,* 257 F.Supp. 372 (D.C. Mich. 1966). From that judgment the Appellants have perfected the instant appeal contesting the Court's rulings covering the claims and specifications; and in addition the Appellee has contested the District Court's holdings on obviousness and inventorship.

In reaching its decision, the District Court wrote a long and comprehensive decision ruling on the issues of anticipation, obviousness, inventorship, compliance of the specifications with Section 112, and compliance of the claims with Section 112. In addition the District Court ruled that the doctrine of file wrapper estoppel applied to prevent the Appellants from claiming the advance that they now allege is the gist of their invention. Since we conclude that the claims overclaim the invention as represented to the Patent Office by the patentees and that the claims cover the prior art, we

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1a. The apparent inconsistency of the District Court's holding that the invention was nonobvious and the holding that the claims cover the prior art results from the manner in which the Court decided the question of obviousness. In fact, the holdings are not necessarily inconsistent since a patentee can disclose a nonobvious invention in his specifications yet claim too broadly, covering not only what is new but also what is old in the art. *Holstensson v. V-M Corp.,* 325 F.2d 109 (6th Cir. 1963).

find it unnecessary to consider the correctness of every ruling of the District Court. On the other hand, a consideration of the factual background of this case and of the errors we find in the District Court's ruling on obviousness will aid in understanding the reasoning by which this Court has reached its decision.

Plaintiffs-Appellants in this action are the owner, the exclusive world-wide licensing firm, and the exclusive licensing agent in the United States of the patent in suit. Vereinigte Oesterreichische Eisen-Und Stahlwerke Aktiengesellschaft (hereinafter VOEST), a steel company owned by the Austrian Government, is the present owner of the patent in suit by virtue of assignment from the patentees, who at the time of the experimentation that led to the application for the patent in suit were employees of VOEST. Brassert Oxygen Technik AG. (hereinafter BOT), a Swiss corporation, was formed in the early 1950's by VOEST and several other European steel companies as the exclusive world-wide licensing agent for a pool of patent rights relating to the use of oxygen in steelmaking, which included the patent in suit after its issuance in 1957. In May of 1954 BOT and the Henry J. Kaiser Company (hereinafter Kaiser), a Nevada corporation, entered into an agreement by which Kaiser became the exclusive licensing agent for BOT in the United States and thus entitled to sue for infringement of the patent in suit when it became a part of the BOT pool of patents.

Appellee McLouth Steel Corporation (hereinafter McLouth), is a Michigan corporation having a steel plant located in Trenton, Michigan, whose operations are alleged to infringe the patent in suit.

In this action McLouth is accused of infringing Patent No. 2,800,631 (hereinafter the Suess Patent), which was issued July 23, 1957, to four Austrian steelmakers, Drs. Theodor Edward Suess, Herbert Trenkler, Hubert Hauttmann and Rudolf Rinesch on the basis of a process developed at Linz, Austria, in 1949, (hereinafter the L-D Process). Only two prior art patents are relied upon by McLouth in this appeal: The Schwarz German Patent No. 735,196 dated July 3, 1943 (hereinafter the Schwarz Patent); and the Miles Belgian Patent No. 486,316 dated March 1, 1947 (hereinafter the Miles Patent). In addition, McLouth relies upon experimentation by Dr. Robert Durrer and Dr. Heinrich Hellbruegge, (hereinafter the Gerlafingen experiment) which was conducted in Gerlafingen, Switzerland, in 1948 and the spring of 1949 and the results of which were fully disclosed to the patentees, as proving noninventorship.

Producing steel from iron ore involves at least two processes. Iron ore, which exists in nature in the form of oxides of iron, is first processed through a blast furnace where the oxygen is removed from the iron ore. This process reduces the iron oxide to relatively pure iron, but it does not remove the other impurities present in the iron ore. In fact, the blast furnace process increases the carbon content of the resultant product, which is known as pig iron. To produce steel from the pig iron, the amounts of these impurities, carbon, silicon, phosphorous, maganese, and sulphur, must be reduced to an acceptable level without adding any significant amount of oxygen or nitrogen. Accomplishing this result is the purpose of the second process involved in steelmaking: the refining process.

The patents involved in this suit are concerned exclusively with the refining process, which involves essentially oxidizing the impurities and removing them from the molten pig iron. Carbon combines with oxygen to form carbon monoxide or carbon dioxide and is exhausted as a gas. Silicon, phosphorous, sulphur, and manganese form various oxides and are absorbed into a slag layer that is formed on top of the metal bath by the addition of lime and other materials before and during the operation. Since the various impurities react with oxygen at different rates, the problem of steelmaking is to control the refining process so that sufficient amounts of all the impurities are removed.

Various methods have been devised to accomplish this refining process. The oldest method is the acid Bessemer process, which was developed in the 1850's and involves blowing air into a molten bath of pig iron from below through tuyeres in the bottom of a converter. This process was unsatisfactory for most pig iron, however, because a basic slag for phosphorous removal could not be formed in the converter, which had an acid refractory lining. As a result, only pig iron with an already sufficiently low phosphorous content could be satisfactorily refined by this method.

The Thomas process, or basic Bessemer process, was devised during 1879 to permit the use of a basic slag capable of removing phorphorous and sulphur. This process also proved unsatisfactory: because air was blown, an excessive nitrogen content developed in the steel produced, and because the blowing was from below, insufficient iron oxide was formed in the slag for phorphorous removal, thus requiring an afterblow for adequate removal of phosphorous.

Although the electric furnace has recently been used for refining, the high cost of the operation has limited its usefulness to the making of specialty steels. Therefore, since the 1880's the principal method of refining steel has been the open hearth process. As late as 1953, approximately eighty-nine per cent of the steel produced in the United States came from open hearth furnaces, which produce steel of excellent quality. The process, however, has the disadvantage of high capital and operating costs and a relatively slow rate of production. An average open hearth heat requires eight to ten hours, while a blow in a Thomas operation requires only approximately eighteen minutes.[2]

The basic process combines the best qualities of the Thomas and the open hearth processes: it produces a steel of excellent quality in a relatively short blowing period; and it has low capital and operating costs. Since VOEST began the first commercial operation of the basic oxygen process at Linz in November, 1952, the process has had a considerable impact on the steelmaking industry. According to the Appellants, more than seventy-five per cent of all new steelmaking facilities constructed since 1954, or now in the planning stage, use the basic oxygen process. Sixteen companies in the United States have begun or planned oxygen blowing facilities, and sixty-four companies in twenty-three countries have installed, or are installing, the new process. The process has demonstrated undoubted advantages over previous methods of refining steel. Its use has resulted in substantial savings to those com-

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2. For a more comprehensive discussion of steelmaking and the history of its development see the District Court's Opinion, 257 F. Supp. at 378-9.

panies now employing the process; and its use in the future will undoubtedly result in substantial savings and improved production for the steel industry as a whole.

McLouth is admittedly using the basic oxygen process. When in 1953 McLouth decided to expand its operations, it learned of the basic oxygen process being used at Linz and sent one of its officers to Linz to observe the operations. Further information about the process was obtained from Kaiser, and in 1954 Kaiser agreed to furnish know-how, engineering knowledge, and consultation services to McLouth at a cost of $100,000. With this assistance McLouth constructed its OP-1 steelmaking shop, the design of the operation being copied from the one at Linz. Although McLouth interpreted the know-how agreement as a license to use the basic oxygen process, Kaiser brought suit for patent infringement. When the Suess Patent was finally granted, the complaint was amended to allege infringement of that patent.

In the District Court, McLouth raised virtually all of the standard defenses in a patent case from invalidity and non-infringement to patent misuse.[3] Although the District Court's judgment for McLouth was based on the Section 112 defenses and although our affirmance is based on the same defense, a discussion of the District Court's treatment of the defense of obviousness will better provide the necessary background. The primary thrust of McLouth's defense appears to be this: when properly practiced the process taught in the prior art Schwarz and Miles Patents produces the same results

3. 257 F. Supp. at 386.

in the same way as the L-D Process disclosed in the specifications of the Suess Patent. In asserting the defense McLouth evidenced some confusion as to whether this contention should be raised under the defense of anticipation or under the defense of obviousness; and McLouth's ambivalence concerning the proper defense seems to have contributed to the District Court's failure to make certain essential findings of fact on the issue of obviousness. We share some of the Appellee's perplexity concerning the proper defense,[4] but in view of the disposition made of the case find it unnecessary to resolve that issue.

Appellants contend that ". . . it lies ill in the mouth of this copyist to assert . . . invalidity . . ." But when the defense is that the advance claimed by the patentees would have been obvious to one skilled in the art, more is involved than a weighing of the equities between the parties. The question becomes one of the public policy in granting patent monopolies and of applying the constitutional and statutory standards requisite to such a grant. *Graham v. John Deere Co.*, 383 U.S. 1 (1966).

In essence McLouth contends that the Linz experiments were nothing more than the development of know-how and engineering knowledge to facilitate the establishment of the first commercial basic oxygen process. If this contention is true, the Appellants had nothing to sell but know-how, which they sold to Mc-

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4. In *Graham v. John Deere Co.*, 383 U.S. 1, 10-2 (1966), the United States Supreme Court noted the confusion that resulted from the early development of the term "invention" as a word of legal art. Although *Graham* went far towards clearing up the confusion, certain areas still remain perplexing.

Louth for $100,000. To counter this contention, the Appellants contend that the patentee's new concept ". . . was the direct antithesis of the thinking then prevalent in the steelmaking art." This penchant of the patentees for creating a verbal antithesis to distinguish every patent that might serve as an interference reference has raised other problems of divining exactly what novel element the patentees claim and how that novel element might be meaningfully distinguished from the prior art. Appellants say that the Suess Patent teaches "avoidance of deep penetration", where the Schwarz and Miles Patents taught "deep penetration". But "avoidance of deep penetration" as an abstract phrase means no more to one skilled in the art than does "deep penetration". Depth of penetration can gain meaning only from the limitations placed upon it by the patents and from the knowledge that may be attributed to an ordinary worker skilled in the art.

The nature of McLouth's defense compels the Court to attempt to distinguish inventive experimentation from mere development of know-how in an art with which the Court has no familiarity. The ultimate distinction is one of law because it amounts to a determination of obviousness or non-obviousness. *A. & P. Tea Co. v. Supermarket Corp.*, 340 U.S. 147 (1950). Several basic factual inquiries are essential, however, to establish a foundation upon which the legal conclusion can be based. The scope and content of the prior art must be determined; the differences between the prior art and the claims at issue must be ascertained; and the level of ordinary skill in the pertinent art must be resolved. *Graham v. John Deere Co.*, 383 U.S. 1, 17 (1966).

In the *Graham* case the United States Supreme Court noted that secondary considerations, such as longfelt but unsolved needs, commercial success, and the like, might have some relevance on the issue of obviousness. 383 U.S. at 17-18. But the Court's further analysis of the Scoggins Patent, 383 U.S. at 26-36, shows clearly that these considerations are truly secondary and will not serve as a substitute for more direct evidence of obviousness. The difficulty we find with the District Court's conclusion of nonobviousness is that the conclusion is based entirely upon these secondary considerations.[5] We do not have the benefit of a complete determination of the difference between the prior

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5. The District Court did not extensively analyze the prior art patents in the section of the Opinion concerned with obviousness. The most extensive analysis of the prior art patents was made in the section of the Opinion concerned with the defense of anticipation, 257 F. Supp. at 387-395, where the test applied was that the disclosures of the prior patents must be so full and complete as to require *no* further experimentation. Whatever the proper test for anticipation may be, that is not the test for obviousness, where the inquiry is whether the experimentation involved was within the ingenuity of a workman having ordinary skills in the art. *Reiner v. I. Leon Co., Inc.*, 285 F.2d 501 (2d Cir. 1960). Because of the stringent test applied, the findings of the District Court in the section concerning anticipation cannot be applied to a determination of obviousness without some qualifications. The same qualifications must be applied to the findings in the section of the Opinion concerned with inventorship, 257 F. Supp. at 406-419, where the same stringent test of "*no* further experimentation" was employed. Since the District Court did not rely upon these findings in concluding that the patentees' invention was nonobvious, we consider them applicable only after a proper evaluation with the test of obviousness in mind.

art and the patent in suit or of any findings concerning the level of skill in the pertinent art.

In determining the prior art a court must consider only the art prior to the date of invention and not read into the prior art knowledge obtained from later disclosures. A foreign inventor, however, cannot establish a date of invention earlier than his first filing date in a foreign country, when that date is earlier than his first filing date in this country. 35 U.S.C. §§ 104 and 119. Patentees filed their first application for a patent on the L-D Process in Austria on January 31, 1950; so that is the earliest termination date for consideration of prior art.

Prior to 1950 not a great deal had been done commercially with the use of pure oxygen in the refining process. McLouth contends that this lapse in the steelmaking industry was due to the unavailability of a method for producing oxygen cheaply in commercial quantities. Appellants contend that the lapse was due to the lack of an operable method for refining steel with pure oxygen. In view of the conflicting evidence, the District Court found that it was unable to ascertain a date when the use of pure oxygen in commercial quantities became economically feasible but held that the unavailability of oxygen in commercial quantities would not necessarily have inhibited experimentation. 257 F.Supp. at 398. We agree with this finding of the District Court but must also note that the lack of commercial quantities of oxygen would affect the quality of the disclosures in the prior art on matters such as specific commercial operating conditions, demonstrative examples, and the like. Moreover, the commercial unavailability of oxygen would explain the absence of any prior

attempts to apply the Schwarz and Miles Patents and would thus weaken any inferences that such a lapse in the industry might raise on the issue of obviousness. Thus, the importance of more direct evidence on the issue of obviousness becomes even more apparent.

However, the District Court found three considerations dispositive of the issue of obviousness: (1) the presumption of validity of a patent; (2) the commercial success of the basic oxygen process; and (3) secondary considerations concerning prior attempts and failures at refining steel with oxygen. 257 F. Supp. at 406. Under the facts of this case, neither commercial success nor the presumption of validity will support a finding of nonobviousness. Commercial success is a relevant consideration only in a close case; it does not by itself establish the validity of a patent. *Dow Chemical Co. v. Halliburton Oil Well Cementing Co.*, 324 U.S. 320 (1945); *Great Atlantic & Pacific Tea Co. v. Supermarket Equipment Co.*, 340 U.S. 147 (1950). Thus consideration of commercial success should be put aside until some conclusion is reached on the basis of more direct evidence of obviousness or non-obviousness.

While it is well recognized that a patent will be presumed valid, 35 U.S.C. § 282, that presumption of validity is not conclusive and will be weakened when pertinent prior art was not considered by the Patent Office. *Harvey v. Levine*, 322 F.2d 481 (6th Cir. 1963); *Aluminum Company of America v. Sperry Products Inc.*, 285 F.2d 911 (6th Cir. 1960); *Tillotson Manufacturing Co. v. Textron, Inc., Homelite*, 337 F.2d 833 (6th Cir. 1964); *Felburn v. New York Central Railroad Company*, 350 F.2d 416 (6th Cir. 1965). In the instant case one of the most pertinent prior art patents, the Schwarz

Patent, was not cited as a reference by the Patent Office and, so far as the record indicates, was not considered by the Patent Office.[6] Avoidance of the Miles Patent as a covering reference was accomplished only by the addition of the claim "avoidance of material agitation of the bath by the oxygen stream." 257 F. Supp. at 404. The Schwarz Patent does not teach agitation of the bath by the oxygen stream; so that claim probably would not have distinguished the Schwarz Patent if it had been before the Patent Office. In similar circumstances this Court has considered that the presumption of validity was not a material factor in determining the validity of a patent. *Harvey v. Levine,* 322 F.2d 481 (6th Cir. 1963), *supra.*

Although the Appellants emphasize the lack of any previous litigation concerning the validity of the Suess Patent and the lack of interferences in the United States Patent Office, the licensing structure of BOT negatives any favorable inferences that might ordinarily arise from such circumstances. When the patentees first developed their process, they became concerned as how best to exploit the process worldwide. They realized that the Schwarz and Miles Patents might serve as interferences or as covering references. So, in the Appellants' words, ". . . to resolve any conflicting claims . . . the exploiting firm of BOT was formed." H. A.

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6. The only mention of the Schwarz Patent in the file wrapper is contained in the affidavits of Rinesch and Hauttmann. These affidavits were submitted only about two weeks before the issuance of the patent, and the record does not indicate what, if any, consideration the Patent Office gave to the affidavits. Such an offhand reference does not amount to Patent Office consideration of the prior art patent.

Brassert & Co., owner of the Schwarz Patent, and VOEST, along with several other European steel companies, were members of BOT from its inception. John Miles and Sons, Ltd., owner of the Miles Patent, became a member of BOT in 1952. The agreements with BOT were essentially license grant-backs: in exchange for placing in the BOT pool of patents their patents on certain uses of oxygen in steelmaking, the members obtained a license to utilize the processes of all other patents in the BOT pool. The agreements also contained provisions for the exchange of know-how and engineering knowledge. In 1954 Kaiser became a part of this arrangement.

Meanwhile, Dr. Suess applied for an Austrian patent on the L-D Process on January 31, 1950; and on January 16, 1951, fifteen days before the one year limitation contained in 35 U.S.C. § 119 would have barred his application, Dr. Suess applied for a patent on the L-D Process in the United States Patent Office. The continuation-in-part application on which a patent finally issued was not filed until 1955. Aside from the antitrust implications that the BOT arrangement might have, see *United States v. Singer Mfg. Co.*, 374 U.S. 174 (1963), since by 1952 it owned all of the most pertinent prior art patents, a reasonable inference might be made that the prior holders of those patents had no great interest in contesting the Suess Patent once it was issued.[7] Also, the most pertinent prior art

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7. This inference is strengthened by the agreements between BOT and its members. For example, the agreement with Brassert concerning the Schwarz Patent concludes:

"For the duration of this agreement Brassert is en-

patents, Miles and Schwarz, were not the type for which an interference would be declared by the Patent Office. See 29 U.S.C. § 135. Hence, the prosecution in the Patent Office was not all that it could have been and would have been if the prior art patents had been owned by competitors of VOEST or had been pending or unexpired United States Patents. These considerations negative any favorable inferences that might be drawn from commercial success or a lack of previous litigation.

We also find the secondary considerations that the District Court relied upon unpersuasive. The District Court found that there had been ". . . a long-standing need for such an invention; [and] . . . many unsuccessful attempts to solve the problem." 257 F. Supp. at 406. We find no evidence in the record to support that finding.

As early as the 1850's the Bessemer process taught that steel could be refined by jetting air into a molten bath of pig iron from tuyeres located in the bottom of a converter. Another line of patents going as far back as the Robert Patent in 1888 taught surface blowing with negligible penetration, 257 F. Supp. at 403. None of these processes proved successful when oxygen was substituted for air. Mere surface blowing causes a dangerous slopping condition, 257 F. Supp. at 400, and when oxygen is blown through tuyeres located in the bottom of a converter the heat of chemical reaction at the gas outlets results in severe refractory damage

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gaged to enter no complaint against any patent, which is owned or controlled by BOT and which concerned the same subject of the patent transferred by this agreement and no protest against applications of such protective rights."

and usually blows out the bottom of the converter. 257 F. Supp. at 378.

But the apparently novel disclosure in the Schwarz Patent that gas could be blown from above with such a force that it would penetrate into a molten bath of pig iron "as a solid body" made all prior attempts to solve the problems confronted by the patentees wholly immaterial. *Graham v. John Deere Co.*, 383 U.S. 1, 36 (1966). Since the Schwarz Patent was a German patent issued in 1943, it is reasonable to assume that because of World War II, it was available to the steelmaking industry as a whole by 1946 at the earliest. The Miles Patent issued in 1947 and made a disclosure similar to Schwarz's. So any problems that might have been involved in *deep* blowing had existed for a relatively short period of time prior to the 1949 Linz experiments. See *Dempster Bros., Inc. v Buffalo Metal Container*, 352 F.2d 420 (2d Cir. 1965).

Other than the Gerlafingen experiments the record does not disclose any extensive attempts and failures to refine steel by deep blowing of oxygen between 1946 and 1949. The circumstances of this case do not allow an inference of such attempts and failures from the absence of any evidence that other companies had applied the process. As to whether other steelmakers independently arrived at the same results as VOEST, the BOT arrangement made it unnecessary for that part of the industry with experience in oxygen blowing to resolve the issue. Since that arrangement provided for the exchange of know-how and engineering knowledge, it would be impossible to separate the contribution of one from the contributions of the others to the basic oxygen process as it is practiced today. So

whether the success of that process is attributable to the disclosure of the Suess Patent is unclear.

In fact, as early as May of 1949, before the Linz experiments, VOEST entered into an agreement with several other European steel companies dividing the burden of experiments in the use of oxygen steelmaking. To VOEST fell the fortuitous obligation of continuing the Gerlafingen experiments, while the other companies were to consider other uses of oxygen in steelmaking. This agreement eliminated several potential competitors of the patentees and negates any inference of extensive experimentation and failures by others skilled in the art. Why others did not avail themselves of the knowledge contained in the Schwarz and Miles Patents is not clear, but it is clear that such evidence is not conclusive on the issue of obviousness. *Graham v. John Deere Co.*, 383 U.S. 1, 36 (1966). The failure to use a patent does not affect the validity of a patent or the persuasiveness of its teachings as a prior art reference. *Tillotson Manufacturing Co. v. Textron, Inc., Homelite,* 337 F.2d 833, 837 (6th Cir. 1964).

We also do not consider the District Court's conclusion that the Schwarz and Miles Patents are inoperable as having much relevance on the issue of obviousness.[8] This finding of the District Court was

8. The only evidence to support the holding was the testimony of the patentees' experts, who had made no experimentations and who testified on the basis of their interpretation of deep penetration as taught by Schwarz and Miles as a penetration that damaged the refractory lining. The District Court found that Schwarz and Miles limited the penetration to a depth that would not damage the refractory lining. 257 F. Supp. at 397-8. So it is doubtfull that this evidence sup-

made in the section of the opinion concerned with the defense of anticipation and seems to have resulted from the stringent test applied in that section. Since the prior art patents did not specifically define the prescribed depths of penetration with reference to the maintenance of a fluid slag, the Court assumed that maintenance of a fluid slag was inconsistent with deep penetration as taught by Schwarz and Miles. Because a fluid slag is necessary in order to remove phosphorous, the Court concluded that the patents were inoperable. If the necessity of maintaining a fluid slag was obvious, however, so defining the depth of penetration would have been unnecessary. Therefore, to conclude from the lack of its inclusion in the definition of the depth of penetration that the characteristic itself is not comprehended within that depth of penetration begs the question when the issue is obviousness.

The application for the continuation-in-part patent was not filed until 1955, and by that time the patentees had the benefit of almost six years of experience in using the basic oxygen process plus whatever information they might have obtained through the BOT arrangement. When compared with the specifications of the parent application, the specifications of the continuation-in-part application reflect the benefit of these years of experience in the extensive discussion of the

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ports a finding of inoperability. For the same reason the Gerlafingen experiments do not prove inoperability. The District Court found that, at Gerlafingen, Dr. Durrer had not solved the refractory damage problem. 257 F. Supp. at 414. This is not a case like *Adams v. United States,* 383 U.S. 39 (1966), where an expert for the plaintiff testified *without contradiction* that he had attempted to build a battery by prior art teachings and the battery had exploded.

chemical reactions and physical phenomena that bring about the good results achieved by the basic oxygen process and in the considerable number of demonstrative examples of proper operating conditions. In comparing the disclosures of this patent with the disclosures of art prior to 1950, one must be careful to separate that part of the description containing well-known technical concepts from that part of the description that differentiates the alleged novel concept of the patentees from the prior art. So far as the District Court went in determining the differences between the disclosures of the Suess Patent and the disclosures of the prior art, we think it did an excellent job in separating the technical descriptions from the decisive distinctions. Therefore a concise statement of those findings will suffice.

Without considering the implications of the first claim of the Suess Patent,[8a] the Court found that patent's teachings to be: (1) that pure oxygen should be used; (2) that it should be blown from above onto and below the surface of the molten bath; (3) that the blowing should be carried out by means of a vertical or almost vertical lance located so that the oxygen jet impinges on the surface of the molten bath at or near the center of the upper surface; (4) that the pressure and nozzle arrangement should be such as to avoid deep

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8a. Since the invention is measured by the claims, perhaps the District Court should have first determined what the claims described as the invention, which the Court later found was not "avoidance of deep penetration". Although the approach causes some confusion, we follow it for the purpose of analyzing the District Court's conclusion on obviousness. See also footnote 1a, *supra*.

penetration of the jet into the bath; and (5) that sufficient heat for the process is produced autogenously in a limited center of chemical reaction spaced a substantial distance away from the refractory lining.

The Schwarz Patent was found to teach: (1) that oxygen enriched air or oxygen should be used; (2) that it should be blown from above into the bath "as a solid body"; (3) that the pressure and nozzle arrangement should be such that the jet penetrates deeply into the bath; and (4) that sufficient heat for the process is produced autogenously in a limited center of chemical reaction located a substantial distance from the refractory lining.[9] Schwarz contained no disclosure concerning the angle of the oxygen lance.

The Miles Patent was found to teach: (1) that an oxygen-nitrogen mixture containing 70% — 98% oxygen should be used; (2) that it should be blown from above with sufficient speed to penetrate into the bath; (3) that the blowing should be carried out by means of a lance placed at an angle of between 15 and 90 degrees to the bath surface, an angle of 30 — 75 degrees being recommended; (4) that the jet should agitate the bath; and (5) that sufficient heat for the process is produced autogenously in a limited center of chemical reaction spaced a substantial distance from the refractory lining.[10] Miles contained no specific teaching of deep penetration, but the District Court implied such a teaching from the recommendation that the gas should be jetted at a supersonic speed.

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9. Disclosure (4) is a paraphrase of the finding of the District Court at page 404 of its Opinion, rather than a paraphrase of the patent.

10. See footnote 9 concerning disclosure (5).

The use of pure oxygen is not claimed as inventive. Nor is the use of a vertical lance located so that the oxygen jet impinges on the molten bath at the center of the upper surface claimed as inventive in view of Miles' suggestion of a 90 degree angle. And the District Court found that the autogenous production of heat in a limited center of chemical reaction located a substantial distance from the refractory lining could not be claimed as an advance over the prior art. In sum, the only difference between the Suess disclosure and the prior art is the teaching of avoidance of deep penetration as opposed to deep penetration.

The difficulty arises in attempting to determine whether that distinction is merely verbal or whether it encompasses a concept that prior to 1950 would have been unobvious to a person skilled in the art. In determining the meaning of "avoidance of deep penetration," the District Court found that the only manner in which that term could be defined was by characteristics of the process. 257 F.Supp. at 400-402. Expert opinion on the percentage of bath depth that was encompassed by "avoidance of deep penetration" varied from thirty per cent to anything less than ninety per cent. 257 F. Supp. at 402. Although depth of penetration is directly related to the pressure and nozzle configuration employed and inversely related to the distance of the lance tip from the bath surface, whether certain arrangements of pressure, nozzle configuration, and bath distance would result in "avoidance of deep penetration" would depend upon the size and depth of the bath.

The characteristics of the process that would place limitations on the depth of the penetration and that

would meaningfully define the depth to one skilled in the art were found to be slopping, refractory damage, and fluidity of the slag. 257 F. Supp. at 402. The District Court found that the specifications of the Suess Patent defined "avoidance of deep penetration" as a penetration sufficient to avoid slopping but not deep enough to seriously impair refractory life or to prevent the formation of the fluid slag necessary for phosphorous removal. However, the Court found that both Schwarz and Miles similarly defined "deep penetration" as a penetration sufficient to avoid slopping but not deep enough to seriously impair refractory life. So it is apparent that the only meaningful distinction between the Suess Patent and the prior art patents is not precisely defined by the antithetical "avoidance of deep penetration" but by the teaching of the necessity of forming and maintaining an early fluid slag.

At this point the District Court should have determined what the prior art taught concerning the necessity of a fluid slag, the method of obtaining a fluid slag, and the feasibility of the suggested method. Having concisely defined the difference between the depth of penetration taught by Suess and the limitation on depth of penetration as "clearly defined" by Schwarz and Miles, the District Court failed to take this further step. Instead, the Court fell back upon the otherwise meaningless antithesis and apparently assumed, since deep penetration was not clearly limited by the teaching of formation of a fluid slag, that maintenance of a fluid slag could not be comprehended by that depth of penetration.

Persuasive evidence in the record, however, indicates that the prior art was aware of the necessity of

maintaining a fluid slag. As indicated, the purpose of the fluid slag is to remove phosphorous; and on this point the Miles Patent teaches that "the silicon and the phosphorous pass into the slag." In explaining the functioning of the slag, Miles further teaches that "the high speed jet causes a vigorous agitation and an entrainment of the slag in the body of the metal, thus assuring an intimate mixture and rapid reactions . . . [and] in each of these cases, the oxygen of the jet reacts not only with the constituent elements of the metal *but also with the slag, thus increasing the oxygen content of the latter and therefore the oxidizing* reactions in general . . . [and further] the jet actually strikes the slag at the surface of the molten metal and acts on the metal by passing through the slag and reaching the metal and/or *by renewing the slag so as to regenerate or increase its power to act on the metal.*" (Emphasis added) Miles also teaches that the speed of the jet of oxygen can be varied, which to one skilled in the art is the same as teaching that the amount of penetration can be varied, and that "[t]he course of the refining can be controlled . . . by varying the velocity of the gases . . ." These disclosures appear clearly to teach that phosphorous is removed by reactions with the slag, that the oxygen jet reacts with the slag and increases the slag's reaction capabilities, and that the course of the refining can be controlled by varying the amount of penetration of the jet. In addition, Dr. Chipman, the patentees' expert, testified that a knowledgeable person skilled in the art would know what he should do to obtain an active slag.

On the other hand, Appellants contend that persons skilled in the art prior to 1950 were so concerned with stirring the bath by the oxygen stream that they would

not have thought refining possible at a depth of penetration where a fluid slag is maintained. The recommendation of supersonic speeds in the prior art patents lends some credence to this assertion. Also, the Gerlafingen experiments show that at least one experimenter had not solved the refractory damage problem. The failures at Gerlafingen, however, are more readily explainable by the cumbersome nature of the equipment used[11] than by any "blind spot" concerning the stirring of the bath. in any event, such an isolated incident can hardly prove that persons skilled in the art in the entire steelmaking industry had a "blind spot" concerning the depth of penetration that would cause them to ignore the other teachings of Schwarz and Miles.

The District Court's conclusion of nonobviousness could have been affirmed if other evidence, whether relied upon or not, had supported that conclusion. *Cold Metal Process Co. v. McLouth Steel Corporation,* 126 F.2d 185 (6th Cir. 1942). Other evidence, however, leaves that conclusion considerably in doubt. On the other hand, if the disclosures of the Miles Patent were the only evidence on obviousness, this Court could reverse, making a finding of obviousness on the disclosures of that document. See *Shumaker v. Graboski In-*

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11. The gist of the negotiations preceding the transfer of the oxygen blowing experiments from Gerlafingen to Linz was that the transfer was made because Gerlafingen did not have an oxygen plant and because other factors made experimentation cumbersome. In addition Dr. Trenkler testified that the lance used at Gerlafingen could not be raised or lowered during the process. Also Dr. Durrer testified that the experiments were moved to Linz because of the better conditions there.

***dustries, Inc.*, 352 F.2d 837 (7th Cir. 1965); *Letcher County, Ky. v. Defoe*, 151 F.2d 987 (6th Cir. 1946).** Conflicts in the evidence, however, require factual determinations which are best entrusted to the District Court in the first instance, and which the District Court did not make in this case. However, the case need not be remanded for further findings because the District Court can be affirmed on another ground.

Assuming that "avoidance of deep penetration" defines some meaningful concept, the claim of the Suess Patent does not describe that concept as the subject matter of the invention and does not distinguish the alleged invention from the prior art. Apparently the patentees were aware that, when it is once admitted that the oxygen jet penetrates into the bath to any not insubstantial degree, it becomes almost impossible to distinguish "deep penetration" as taught by Schwarz and Miles from "avoidance of deep penetration" as taught by the patentees. The various patent applications on the L-D Process reflect this difficulty. When confronted by an interference by the Schwarz Patent in making application for a German patent, Dr. Suess replied:

> "In contradistinction to . . . [Schwarz], in the case of the present invention the molten bath is blown with so little kinetic energy that the oxygen does not penetrate. . . ."

And later to further opposition Dr. Suess again replied:

> ". . . the oxygen is not blown into the molten bath, but rather onto the surface of the bath and reacts at the surface. . . The jet of oxygen . . . acts only on the surface. . ."

Likewise in their Australian application for a patent the patentees stated that ". . . the gas jet does not penetrate into the bath of molten metal . . . [and further] an essential characteristic of the invention is that the gas jet does not penetrate into the bath . . ." In other applications the amount of penetration was not even urged as the gist of the invention; rather the patentees contended that the good results of the L-D Process were due to the maintenance of a proper ratio between the bath surface and the bath depth.[12]

Standing alone, this evidence of statements in foreign applications for patents would not necessarily bind the patentees to any particular description of avoidance of deep penetration. The same arguments, however, were used in the prosecution of the United States applications. When confronted by interference from the Miles Patent, the patentees stated:

> "[the] . . . conditions of blast nozzle operation . . . distinguish the applicant's method from the Miles et al. method in emphasizing a much lower impingement pressure and a practically negligible penetration of the surface of the molten metal by the oxygen jet . . . [and also] it will be evident that the blast velocity at the surface of the bath will be insufficient to cause any substantial penetration of the bath by the jet."

Also in an attempt to obtain a patent after a protracted prosecution in the Patent Office, Dr. Rinesch and Dr. Hauttmann, two of the patentees, filed affidavits to dis-

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12. This ratio theory was also the basis of the earlier Suess application, which was rejected by the United States Patent Office and finally abandoned.

tinguish the Miles and Schwarz methods of deep blowing. To support their claim that "avoidance of deep penetration" was "just the opposite of the methods disclosed in the Schwarz and Miles et al. patents. . . ." Dr. Rinesch stated that the jet did not penetrate "appreciably" into the bath and further limited the center of reaction to the "surface layer". Likewise, Dr. Hauttmann limited the reactions caused by the oxygen jet to "the surface layer of the bath".

On the basis of this evidence the District Court found:

> "Clearly the patentees and their attorneys defined the avoidance of deep penetration as practically no penetration at all in order to distinguish the prior art for purposes of prosecuting their own patent applications."

Having consistently and repeatedly limited "avoidance of deep penetration" to a "practically negligible" penetration or to a "surface layer" penetration or to no penetration when faced with an interference from the Schwarz and Miles Patents, both in the United States Patent Office and in foreign patent offices, the patentees now seek a broader description of that term encompassing any penetration of one half the bath depth or less.

Dr. Trenkler testified that "avoidance of deep penetration" meant a penetration of from one-third to one-half the bath depth. Dr. Hauttmann testified that the L-D Process involved a penetration of not more than one-half of the bath depth. Appellants' experts also testified concerning an "avoidance of deep penetration" that was considerably more than negligible. 257 F. Supp. at 402. We held in *Thabet Mfg. Co. v Kool Vent*

Metal Awning Corp., 226 F.2d 207 (6th Cir. 1955), that, when a patentee defines a term and the Patent Office accepts that interpretation, the Court will give the same interpretation to the term. In prosecuting their patent application, the patentees clearly limited "avoidance of deep penetration" to a "practically negligible" penetration. The Patent Office accepted that interpretation of the term; so the patentees are not now entitled to an interpretation of "avoidance of deep penetration" encompassing more than the limitation accepted by the Patent Office. *Westinghouse Electric Corp. v. Hanovia Chem. & Mfg. Co.*, 179 F.2d 293 (3rd Cir. 1949); *Doran Coffee Roasting Co. v. Wyatt Manufacturing Co.*, 267 F.2d 200 (10th Cir. 1959).

Appellants have insisted throughout this case that they regard the subject matter of the patentees' invention to be "avoidance of deep penetration". The proposition is too well settled to need citation that the claims measure the invention. Congress has provided in 35 U.S.C. § 112:

> "The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention."

The Suess Patent concluded with two claims, only one of which need be considered. Claim 1 of the Patent states:

> "1. Method of refining molten impure iron in the presence of a slag in a vessel having a refractory lining by blowing with oxygen, which comprises discharging a stream of oxygen vertically downwardly through the slag layer onto and below the surface of the bath at the central portion thereof,

to an extent to avoid material agitation of the bath by the oxygen stream, the contact of the oxygen with the bath resulting in reaction of the oxygen with a portion of the iron and with the oxidizable impurities of the bath in a localized reaction zone spaced a substantial distance from the refractory lining, the reactions in said zone resulting in refining of the iron and gas evolution and in the production of high temperature in the reaction zone away from the refractory lining, said reaction producing a circulatory movement in the molten metal, which circulatory movement brings those portions of the molten metal bath which are remote from the reaction zone into the reaction zone whereby those portions are subjected to said reaction with minimum injury to the refractory lining."

No express reference to "avoidance of deep penetration" is made in the claim. Appellants attempt to incorporate the term in the claim by relating it to the phrase ". . . to an extent to avoid material agitation of the bath by the oxygen stream . . ." and to the phrase ". . . contact of the oxygen with the bath resulting in . . . a localized reaction zone spaced a substantial distance from the refractory lining . . ." Yet neither of those phrases can be interpreted as limiting the penetration of the oxygen stream to a "practically negligible" penetration. In the case of an improvement patent, the United States Supreme Court stated in *Halliburton Oil Well Cementing Co. v. Walker,* 329 U.S. 1 (1946), that a patentee cannot obtain greater coverage for his patent by failing to describe his alleged invention than by describing it as the statute commands. We find that rule just as applicable to a process patent.

In the specifications of the Suess Patent no description of the process refers to material agitation of the bath by the oxygen stream, and no description relates agitation or the avoidance of agitation to the depth of penetration of the oxygen jet. The District Court found that the phrase "material agitation" had no meaning to one skilled in the art, and we find that ruling amply supported by the evidence. Appellants contend, however, that the phrase must be given the meaning attributed to it by the patentees as reflected in the affidavits of Dr. Rinesch and Dr. Hauttmann. In so contending the Appellants urge this Court to place an unreasonable construction on the rule stated in *Kool Vent*. That case in effect held that when a patentee places a certain limitation upon a term used in his patent he cannot later expand the scope of the term by ignoring his earlier restrictive interpretation. Appellants would have us read the rule as permitting a patentee to give meaning to a meaningless term through affidavits submitted to the Patent Office and filed somewhere obscurely in the file wrapper history of the patent.

The patent law does not require a prospective inventor to search so far in attempting to determine the scope of a patent and the areas left open for inventive inquiry. Section 112 provides that it is the claims that shall *particularly point out* and *distinctly* claim the subject matter of the patentee's invention. Certainly, terms used in the claims can gain meaning from the specifications or from the knowledge attributable to one skilled in the art. But a prospective inventor is required to go no further in attempting to determine the invention claimed and the areas foreclosed to future enterprise. When read in light of the specifications,

these claims would not describe a "practically negligible" penetration to one skilled in the art. Hence, the patentees failed to describe their invention.

The only meaningful limitation placed on the depth of penetration of the oxygen stream is the phrase ". . . a localized reaction zone spaced a substantial distance from the refractory lining." The District Court found that both Schwarz and Miles placed the same limitation on depth of penetration. So if the only difference between the patentees' process and the process taught by Schwarz and Miles is the depth of penetration of the oxygen stream, the patentees have failed to distinguish their depth of penetration in any way from the depth of penetration taught by the prior art. We recently held in *Holstensson v. V-M Corporation,* 325 F.2d 109 (6th Cir. 1963), that a policy in the patent law ". . . visits total forfeiture upon a patent which attempts to extend its monopoly to something already patented." 325 F.2d at 122. That case concerned an improvement patent, but we find the rule just as applicable to the patent in suit.

In our view of this case, the Appellants ask this Court to ignore the precision of definition required of them by the statute. As the Supreme Court noted in *United Carbon Co. v. Binney Co.,* 317 U.S. 228 (1942), to allow claims "so indefinite as not to give the notice required by the statute would be in direct contravention of the public interest which Congress . . . recognized and sought to protect." In that case the Court considered a product patent where the distinction from the prior art was a matter of degree. The Court rejected terms, such as "substantially pure", "commercially uni-

form", and "comparatively small", that gave no standard for comparison or were so indefinite as to have no established meaning to one skilled in the art.

Likewise, in the instant case we are concerned with a patent that varies from the prior art only in the alleged degree of penetration of the oxygen stream. But the only term allegedly defining that difference has no established meaning. When patentees' experts were asked when agitation became material, they uniformly replied, "I don't know." As indicated earlier the specifications nowhere establish a standard for determining when agitation becomes material and nowhere relates the amount of agitation to the depth of penetration. The knowledge attributable to one skilled in the art will also not aid the patentees in reading their alleged invention into the claim. Whatever interpretation one skilled in the art might have placed on "avoidance of material agitation", it would not have been the "practically negligible" penetration that the patentees represented to the Patent Office as "avoidance of deep penetration." The District Court found that continued shallow blowing causes a turbulent slopping condition.

Although a slopping condition might appear inconsistent with what the specifications would teach one skilled in the art concerning the depth of penetration of the oxygen stream, the inconsistency arises because of the inconsistent positions that the patentees assumed before the Patent Office. If the patentees had contended for the amount of penetration before the Patent Office that they now urge upon this Court, their patent would probably not have passed muster. The inconsistency could have resulted from the rather indeter-

minate nature of the patentees' advance over the prior art, or it could have resulted from an attempt to get an artfully worded restatement of the prior art through the Patent Office. Under similar circumstances in the *Binney Co.* case the Supreme Court stated:

> "Whether the vagueness of the claim has its source in the language employed or in the somewhat indeterminate character of the advance claimed to have been made in the art is not material. An invention must be capable of accurate definition, and it must be accurately defined, to be patentable." 317 U.S. at 237.

We find that the patentees failed to define their alleged advance over the prior art and that in failing to properly limit their claims they attempted to extend their monopoly to something already patented. For either reason, or for both reasons, the patent must be held invalid.

Even if "avoidance of deep penetration" could be given a broader meaning than "a practically negligible penetration", another reason prevents the claims from being read so as to contain that limitation. The District Court found that the doctrine of file wrapper estoppel prevented the patentees from incorporating the limitation of "avoidance of deep penetration" into their Claim 1. If the patentees cannot limit their claim to this sole patentable advance over the prior art, the patent is invalid regardless of any other findings of the District Court. Resolution of the question requires certain factual inquiries into the file wrapper history of continuation-in-part Application No. 547,233.

In attempting to apply the doctrine of file wrapper estoppel to the facts of the instant case, two considerations must be borne in mind: (1) 35 U.S.C. § 282 specifically provides that a patent shall be presumed to be valid and the burden of proving invalidity shall rest upon the person asserting that the patent is a nullity; thus, in the present case McLouth has the burden of proving that the patent is void; and (2) the estoppel is invoked in connection with the plaintiff's attempt to satisfy that requirement of 35 U.S.C. § 112 which provides, "the specifications shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention."

The basic principle underlying file wrapper estoppel is that "a party cannot take inconsistent positions concerning the same subject matter in different transactions." 4 Walker, Patents § 234, p. 87 (Deller 2.d ed. 1965). In making its holding concerning file wrapper estoppel, the District Court relied heavily upon *Schriber-Schroth Co. v. Cleveland Trust Co.*, 311 U.S. 211 (1940). There the Court phrased the doctrine in these words:

> "But the particular invention to which the patentee has made claim in conformity to the statute is not always to be ascertained from an inspection of the specifications and claims of the patent alone. Where the patentee in the course of his application in the patent office has by amendment cancelled or surrendered claims, those which are allowed are to be read in the light of those abandoned and an abandoned claim cannot be revived and restored to the patent by reading it by construction into the claims which are allowed." 311 U.S. at 218.

Hence, the determinative question on this issue is whether the Appellants did in fact cancel, surrender, or abandon the claim of "avoidance of deep penetration by the oxygen stream" during the prosecution of Patent Application No. 547,233.

In *Schriber,* cited by this Court in *Bobertz v. General Motors Corporation,* 228 F.2d 94 (6th Cir. 1955), the Supreme Court said:

> "It is a rule of patent construction consistently observed that a claim in a patent as allowed must be read and interpreted with reference to claims that have been cancelled or rejected, and the claims allowed cannot by construction be read to cover what was thus eliminated from the patent. [Citing cases.] The patentee may not, by resort to the doctrine of equivalents, give to an allowed claim a scope which it might have had without the amendments, the cancellation of which amounts to a disclaimer. (Citing cases.)
>
> The injurious consequences to the public and to inventors and patent applicants if patentees were thus permitted to revise cancelled or rejected claims and restore them to their patents are manifest. See Leggett v. Avery, 101 U.S. 256, 259, 25 L.Ed. 865.
>
> "True, the rule is most frequently invoked when the original and cancelled claim is broader than that allowed, but the rule and the reason for it are the same if the cancelled or rejected claim be narrower. (Citing cases, Cf. Smith v. Magic City Kennel Club, Incorporated, 282 U.S. 784, 790, 51 S. Ct. 291, 75 L.Ed. 707)." 311 U.S. at 220-1.

In making this determination the only pertinent material in the file wrapper history of Application No. 547,233 would appear to be the parent patent Application No. 206,147 together with Patent Office correspondence, the present patent and answers of the Examiner concerning prior rejected claims, the patents against which Application No. 547, 233 was compared,[13] and the affidavits submitted with the final change in claims.[14]

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13. In the prosecution of Application No. 547,233 perhaps the Examiner considered some patents as prior art, which should not have been so considered. (e.g. the Cuscoleca Patent, filed on December 22, 1954). But whether the patentee could have been legally required to give up the claim surrendered is immaterial, the question in applying the doctrine of file wrapper estoppel is whether the patentee did *in fact* give up the claim. If the patentee disagreed with the Examiner, his remedy was appeal; he cannot give up the claim and then attempt to recover it through collateral infringement suits. *Schriber-Schroth Co. v. Cleveland Trust Co.*, 311 U.S. 211, 221 (1940). Therefore in determining what was abandoned in the rejected claims, all of the patents with which No. 547,233 was compared must be considered. Those patents were: (foreign patents are designated as such) Miles Patents (British and French)

Potts Patent (British)
Cuscoleca Patent
Cheswick Patent
Kalling Patent
Brassert Patent

Only the Cuscoleca Patent is included in the record on appeal. The assumed conflict with the other patents must be determined from correspondence in the file wrapper history of No. 547,233 and No. 206,147.

14. Although these affidavits might not be pertinent in determining other issues, such as whether the specifications support the claims, *Cf. Tillotson Mfg. Co.*

When making the parent Application, No. 206,147, in 1951, Dr. Suess did not emphasize avoidance of deep penetration as of any great significance in the process. Only one off-hand reference was made in the description that a certain pressure and nozzle arrangement would bring "about a sufficiently high reaction velocity without deep penetration of the gas into the molten bath." No claim referred to avoidance of deep penetration as an element of the process. After final rejection of No. 206,147, the Appellants on March 20, 1956, cancelled all prior claims and submitted two claims to place "the case in better form for consideration on appeal." In one of those claims, Claim 14, a reference was made to avoidance of "deep penetration of the oxygen jet into the molten metal."[15] This entire Application

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v. Textron, Inc., Homelite, 337 F.2d 833 (6th Cir. 1964), it seems that they would be appropriate considerations in determining exactly what elements of the prior claims were abandoned on submission of the final claims, in absence of other more direct evidence.

15. Section 120 of Title 35 of the United States Code grants the benefit of the earlier filing date of the parent patent, to a continuation-in-part patent when the invention was "disclosed in the manner provided by the first paragraph of Section 112 . . . in . . ." the earlier "application previously filed . . . by the same inventor . . ." Since the continuation-in-part application was made in 1955 and since the only claim containing any reference to the subject matter of avoidance of deep penetration was not made until 1956, apparently as an after-thought, some question might be raised whether the alleged invention of avoidance of deep penetration is entitled to the benefit of the earlier filing date. *Merry Manufacturing Company v. Burns Tool Company,* 335 F.2d 239 (5th Cir. 1964). If it was not so entitled, the claim would be barred by Dr. Suess' 1950 Austrian patent. 35 U.S.C. § 119. That issue, however, has not been raised in this case.

was abandoned before any Patent Office action was taken; so none of the Patent Office correspondence on No. 206,147 has much relevance on the issue of file wrapper estoppel.

Application No. 547,233, however, does make references to "avoiding deep penetration by the oxygen jet." That phrase is incorporated into each of Claims 1 through 4. In the Patent Office rejection of these claims the Examiner held them unpatentable over Brassert and Cheswick and Kalling. Brassert was said to disclose "the use of a blast of oxygen into the surface of the molten metal . . ." and "regulating the pressure and amount of the compressed air or blast . . ." Cheswick was said to disclose "the use of an oxygen blast upon the surface of molten steel for refining purposes," and Kalling was said to make the use of surface blowing "to prevent local attacks upon the furnace lining" old art. Claims 1 through 15 were rejected over the Miles French Patent and Cuscoleca. Miles was said to disclose surface blowing "with a pressure of 7 to 8 atmosphere." Most of the indicated conflicts relate in some manner to the penetration of the oxygen stream: (1) surface blowing implies very little, if any penetration; and (2) the depth of penetration is directly related to the pressure with which the oxygen is blown. On the other hand, the Examiner did not mention avoidance of deep penetration directly as a conflicting element.

The Appellants, in response to the rejection, cancelled Claims 1 through 10 but amended Claim 12 to include the statement "to avoid substantial penetration of the jet into said bath." Also Claim 16 was added, which included in it the statement, "the pressure and nozzle

spacing being related to avoid deep penetration of the oxygen jet into the molten metal." The remarks following the submission of these amendments make it clear that the Appellants considered avoidance of deep penetration an important part of the invention, specifically emphasizing "the very important particular of depth of penetration of the molten bath by the jet of oxygen."

The Patent Office never took action on these claims. Pursuant to a discussion with the Examiner, however, the amended Claims were cancelled, and Claims 17 and 18 submitted in their place. These new Claims, which with minor amendments became the final Claims, did not contain any direct reference to avoidance of deep penetration. Also the remarks accompanying the submission of the new Claims contained no reference to avoidance of deep penetration. The only references were contained in affidavits submitted by two of the patentees, Dr. Rinesch and Dr. Hauttmann.

We believe that sound inferences can be drawn from the Patent Office's rejections of earlier claims which contained the element of avoidance of deep penetration and its reference to the Cuscoleca Patent. Although the record is void as to the content of the discussion with the Examiner on May 1, 1957, we believe that an inference of abandonment can be drawn from the omission of "avoidance of deep penetration" from the final claims. In our opinion, if the element was as important as the affidavits imply, it would have been explicitly included in the claims; the Patentees were well aware that our patent laws require that the claims "distinctly" claim the alleged invention. The Appellants cannot regain the phrase or qualify the effect of their acquiescence through the affidavits. *Parke, Davis & Co. v. American Cyanamid Co.*, 207 F.2d 571, 574 (6th Cir. 1953). In

the face of prior rejections, the claim allowed, cannot, by construction or affidavit, be read to cover that which was specifically abandoned by the patentee so as to give the allowed claim a scope it might have had without the omission of the language.

In this case the issue of file wrapper estoppel hinges entirely upon the factual determination of abandonment or non-abandonment.[16] While the record does not indicate whether the District Court made any extensive factual inquiry into this problem, we believe the Court was correct in its view that abandonment is established if a phrase used in an abandoned or rejected claim is not used in a later accepted claim.

The determination being essentially a factual one, prior cases do not offer any clear-cut guide lines concerning what constitutes abandonment or non-abandon-

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16. Certain assertions made by the Appellants deserve comment at this point. The argument that "avoidance of deep penetration" was included in Amended Claim 12 and added Claim 16 and that these Claims were *never rejected* is immaterial except for the factual inferences that might be drawn. The doctrine is equally applicable to claims given up informally pursuant to a discussion or conference as to claims given up after a formal rejection. *Graham v. John Deere Co.*, 383 U.S. 1, 32-3 (1966). That the claims allowed were broader than they would have been if the omitted phrase had been included is likewise immaterial. *Schriber-Schroth Co. v. Cleveland Trust Co.*, 311 U.S. 211, 221 (1940). As pointed out earlier, the accompanying affidavits cannot be utilized to recover the abandoned claim if its relinquishment was in fact required by the Examiner during the "discussion". *Parke, Davis & Co. v. American Cyanamid Co.*, 207 F. 2d 571 (6th Cir. 1953). The only disputable finding, therefore, is the factual determination of abandonment.

ment. Most of the cases involved a *limitation* specifically imposed upon the claims by the Applicant and the Applicant was precluded in a later infringement suit from placing a broader interpretation on the Claims.[17] Here the process was reversed; the Applicant was refused a narrow claim and granted a broader claim. Although this difference does not affect the application of the doctrine of file wrapper estoppel, it does make the

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17. In these cases the factual determination was easier, because it is easier to prove the purpose of a positive occurrence such as an inclusion of an element than to prove the purpose of a negative occurrence such as the omission of an element. Was the omission made purposely or was it made under the assumption that an included phrase was the omitted phrase's equivalent? The difficulty of the determination is compounded when the final claim is broader than the cancelled claim. See *Graham v. John Deere Co.*, 383 U.S. 1, 32-3 (1966) (limitations were specifically spelled out in remarks accompanying the final submission); *Exhibit Supply Co. v. Ace Corp.*, 315 U.S. 126, 136-7 (1942) (claims limited to conductors embedded in table clear from prior rejected claims); *Keystone Co. v. Northwest Eng. Co.*, 294 U.S. 42, 47-9 (1935) (limitation clear from letter from applicant's solicitor); *Smith v. Magic City Kennel Club, Inc.*, 282 U.S. 784, 788-9 (1931); (limitation clear from prior rejection references); *I. T. S. Rubber Co. v. Essex Rubber Co.*, 272 U.S. 429, 439 (1926) (limitation clear from prior rejection reference); *Parke, Davis & Co. v. American Cyanamid Co.*, 207 F.2d 571, 574 (6th Cir. 1953) (limitation clear from statements of Patent Office); *Lyon, Inc. v. Clayton & Lambert Mfg. Co.*, 127 F.2d 164 (6th Cir. 1942) (facts not clear); *Valjean v. Perfection Stove Co.*, 103 F.2d 60, 61-2 (6th Cir. 1939) (limitations clear from rejection reference and statements of Patent Office); *Bishop & Babcock Mfg. Co. v. Western Auto Supply Co.*, 105 F.2d 886, 889 (6th Cir. 1939) (limitation clear from representations to Patent Office); *Firestone Tire & Rubber Co. v. United States Rubber Co.*, 79 F.2d 948, 954-5 (6th Cir. 1935) (limitation clear from rejection reference).

factual determination more difficult. In relying upon *Schriber-Schroth Co. v. Cleveland Trust Co.*, 311 U.S. 211 (1940), the District Court chose the case most directly in point factually with the instant situation.

Many of the facts in the *Schriber Co.* case are identical to the instant case. The question in *Schriber Co.* was whether the Jardine Patent for a piston contained a claim of a flexible web feature. 311 U.S. at 218. As the Applicants in the instant case, Jardine did not claim flexible webs as a feature in the claims originally filed; and while the application was pending, Jardine amended the claims to supply this omission; here the patentees filed a continuation-in-part application to supply the omissions. As in the instant case, these claims were rejected as reading upon other patents; as a result the claims were cancelled and new claims submitted that did not contain a claim for flexible webs. Also as here, the claims that were finally allowed were broader than if the omitted claim had been included. Appellants attempt to distinguish *Schriber Co.* on the grounds that in that case the limiting phrase was omitted as the result of an interference proceeding. That fact cannot be a distinguishing feature of the case, however, see *Graham v. John Deere Co.*, 383 U.S. 1, 32-3 (1966); otherwise, the doctrine of file wrapper estoppel would never apply to a patent where, as in the instant case, the only pertinent prior art consisted of foreign patents, because interference proceedings will not be declared on such patents by the Patent Office. 29 U.S.C. § 135.

The District Court concluded that *Schriber Co.* controlled the result concerning file wrapper estoppel. Judge Weick and I agree. Judge Edwards joins in the opinion in all respects except that he does not feel that the defense of file wrapper estoppel is established by the record.

Affirmed.

HENRY J. KAISER CO., *et al.*

v.

MCLOUTH STEEL CORP.

[No. 16900; decided July 6, 1966]

FREEMAN, District Judge.

This is an action for infringement of patent No. 2,800,631 involving a process of making steel by jetting high purity oxygen downwardly onto a bath of molten pig iron. The patent was issued July 23, 1957, to four Austrian steelmakers, Drs. Theodor Eduard Suess, Herbert Trenkler, Hubert Hauttmann and Rudolf Rinesch, as joint inventors, on the basis of experimentation with the use of pure oxygen in steelmaking dating back to June of 1949. At that time, all four men were employed by plaintiff Vereinigte Oesterreichische Eisen-und Stahlwerke Aktiengesellschaft (hereinafter called "VOEST") a steel company owned by the Austrian Government having its main factory at Linz, Austria. VOEST is presently owner of the patent in suit and all rights pertaining thereto, by virtue of assignment from the patentees. Other plaintiffs in this litigation are Brassert Oxygen Technik AG., (hereinafter called "BOT"), a Swiss corporation which is the exclusive world-wide licensing firm for the patent in suit; and Henry J. Kaiser Company (hereinafter called "Kaiser"), a Nevada corporation which is the exclusive licensing agent in the United States for the patent.

Defendant in this case is McLouth Steel Corporation (hereinafter called "McLouth"), a Michigan corporation having a place of business at Trenton, Michigan, where a steel plant is located, whose operations are alleged to infringe the patent in suit.

The oxygen steelmaking process at issue in this litigation has demonstrated in recent years undoubted advantages over older methods of steelmaking, including reduction of capital and operating costs, increase of production rates, and improvement [2] in quality of the steel produced. Therefore, perfection of the process has resulted in its large-scale adoption in the United States and throughout the world. Defendant McLouth has admitted that the new oxygen steelmaking process is "a revolutionary method of making high quality steel." (PX 96A; R. 1107, 1310.) Additionally, the process has been characterized by the President of Jones & Laughlin Steel Company as "the only major technological breakthrough at the ingot level in the steel industry since before the turn of the century." (PX 92-7; R. 1233-34.)

Basically, plaintiffs contend that the four patentees were joint inventors of this oxygen steelmaking process at Linz, Austria, in June of 1949, and that the process is the subject matter of the patent in suit, allegedly infringed by McLouth. Defendant denies these contentions and also asserts a defense of patent misuse.

I. BACKGROUND OF THIS LITIGATION

A brief discussion of the background of this litigation may serve to clarify the issues and also to provide a general perspective for the more detailed analysis of each issue to follow.*

[3] A. Steelmaking Prior to the Tests At Linz, Austria, in 1949

Steel is simply iron containing a very small percentage of other elements such as carbon, phosphorus, manganese, silicon and sulphur. Iron is found in nature in oxide forms, mixed with impurities. Thus the proc-

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*The litigation has been unusually long and complex. After several years of pretrial research, experimentation and discovery, the case came to trial in October, 1963. Trial of the case required 150 days of court time, spread over an entire calendar year. More than 13,800 pages of testimony were taken, consisting largely of scientific evidence, much of which required the use of interpreters. A great number of exhibits were received in evidence, including large testing equipment, test pieces, and many demonstration movie films, as well as a considerable volume of documentary evidence. At the conclusion of the trial, briefs were prepared and submitted by the parties, totaling nearly 1000 printed pages. Final arguments lasted five days.

The Court expresses grateful appreciation to the parties and counsel for their consideration in providing the Court with a daily transcript of the testimony, bound regularly from time to time in convenient book form and also reproducing most of the documentary exhibits in uniform size and placing them in looseleaf binders for the Court's convenience. The testimony and documentary exhibits in such form occupy approximately an equal amount of library shelf space, totaling more than twelve feet.

ess of steelmaking involves reduction of iron oxide to pure iron and the removal of impurities to acceptable levels for the quality of steel desired. The blast furnace, an invention probably of Chinese origin and introduced in Europe in the sixteenth century, performs the function of reducing iron ore to relatively pure iron, but fails to separate other elements from the iron sufficiently to produce steel. In fact, the iron produced by the blast furnace, known as pig iron, acquires roughly four per cent carbon as a result of the blast furnace operation as residue from coke used in the operation to reduce iron oxide. (R. 210.) Therefore, further refining of the molten pig iron produced by the blast furnace is required to make steel. The purpose of such refining is to lower the carbon, silicon, phosphorus, manganese and sulphur content of the pig iron to desirable levels, preferably without adding any significant amounts of oxygen or nitrogen to the final steel as a result of the refining process. For example, excessive amounts of carbon, phosphorus and nitrogen cause the steel to be too brittle for many purposes. Too much sulphur has the same effect and also tends to cause surface defects in the steel produced. (R. 233-35.) On the other hand, steel with a too low manganese content will not roll or forge properly. (Re. 227-28). In the [4] process of refining pig iron, the elements of carbon, silicon, manganese and phosphorus combine with oxygen to form oxides which go into a slag layer on top of the metal bath or into the air in the form of carbon monoxide and carbon dioxide. Essentially, the problem of steelmaking is to control the refining process so as to remove sufficient amounts of all the impurities, although the various reactions do not necessarily occur at the same time.

The refining of pig iron into steel may be accomplished by any of several processes. The oldest of these, the Bessemer process, was developed in the 1850's and involves blowing air into a molten bath of pig iron from below through tuyeres in the bottom of a converter. The original Bessemer process, which used a so-called acid refractory lined with material containing silica, an acidic oxide, has proved unsatisfactory in several respects. In the first place, phosphorus is not removed, because the basic slag required for phosphorus removal cannot be used with an acid refractory. Thus the acid Bessemer process can only be used to refine pig iron which already contains a sufficiently low phosphorus content. The relative rarity of such pig iron places a serious restriction on the usefulness of the acid Bessemer process. Further, sulphur is not removed in the acid Bessemer process for the same reason. Additionally, the blowing of air into the bath causes an objectionable amount of nitrogen from the air to remain in the steel. Attempts to solve the nitrogen problem in the 1940's by blowing pure oxygen instead of air through the bottom [5] were unsuccessful because the greater heat of chemical reactions caused by pure oxygen immediately resulted in severe refractory damage.

The Thomas process, also known as the basic Bessemer process, was originated in 1879. This process requires the use of a basic lining, which permits the use of a basic slag capable of removing phosphorus and sulphur from the pig iron. However, the process makes steel which is unsatisfactory for many purposes because of an excessive nitrogen content in the steel produced. In the Thomas process, a so-called afterblow is required to remove phosphorus from the metal bath, since almost

no phosphorus is removed during the main blow when the removal of carbon, silicon and manganese takes place. Phosphorus removal requires iron oxide in the slag, but in the Thomas process, insufficient iron oxide forms in the slag to remove phosphorus until the time of the afterblow.

The principal method for refining pig iron into steel since the 1880's has been the open hearth process, which involves heating large quantities of pig iron in a furnace by means of fuel oil blown onto the surface of the bath. The open hearth process successfully removes objectionable amounts of carbon, silicon, phosphorus, manganese and sulphur from the pig iron without at the same time injecting excessive nitrogen or oxygen into the steel produced. In 1953, approximately 89% of the steel produced in the United States came from open hearth furnaces. (R. 5890.) Although the steel produced by the open hearth process is of excellent quality, the process has the disadvantages of high capital and operating costs as well as a relatively slow rate of production, an average heating requiring [6] eight to ten hours (R. 276-276-A) as compared to a blow of roughly eighteen minutes in a Thomas operation. (R. 246.)

Another process which has been used in the last sixty years for steelmaking is the electric furnace, which makes use of an arc between electrodes to heat the metal charge. The electric furnace process is generally not used for low carbon steel because of the high cost of this type of operation. The process has been used primarily for making specialty steels.

It should be noted that various attempts were made from the 1880's on to make steel successfully by blow-

ing air from above onto the surface of a bath of molten pig iron, usually from tuyeres located in the converter wall above the surface of the bath. The work of Robert, Deemer and Brassert was significant in this regard (DX 61), but there is no evidence that such attempts led to any practical results in commercial steelmaking.

In 1928, the invention of the Linde-Fraenkl process of producing pure oxygen cheaply in large tonnage quantities created the possibility of the use of pure oxygen in the commercial refining of pig iron into steel. (R. 5068.) Starting in the 1930's, at least limited experimentation was carried on in Europe by men including Herman Brassert, Dr. Carl Schwarz and Dr. Robert Durrer using oxygen in the refinement of steel. (R. 5074, 5084, 5085.) Such experimentation led to the application by Schwarz in 1939 for a German patent on a new process of blowing oxygen from above a bath of molten pig iron deeply into the bath "in the manner of a solid body." (DX 61, Schwarz.) The patent was issued in 1943, but there is no evidence that Schwarz' work led to any practical results in commercial operations. (R. 5085.) In the 1940's, especially after World War II, [7] pure oxygen apparently became more readily available at low cost, and experimentation with oxygen in steelmaking increased in intensity. In 1946, a Belgian patent was issued to John Miles on a process involving blowing oxygen from above into a bath of molten pig iron, preferably at an angle between 35% to 70%, so as to agitate the bath by the oxygen jet. (DX 61, Miles.) Again, there is no evidence that Miles's work led to practical results in commercial operations (R. 5085), and in fact there is admittedly no evidence that steel with satisfactory phosphorus and sulphur

content was made commercially by anyone in the 1940's using a pure oxygen blowing process (R. 13, 484-86), despite extensive experimentation by a number of men in several countries of Europe. Such experimentation included a series of tests conducted in Gerlafingen, Switzerland, by Dr. Durrer and Dr. Heinrich Hellbruegge in 1948 and the spring of 1949, blowing pure oxygen downward into a bath of molten pig iron, using an afterblow to remove phosphorus after carbon had been removed in the main blow. (DX 61; R. 4915.) These tests produced steel satisfactory for some purposes, despite apparent refractory damage and an objectionably high phosphorus content in the steel produced. (R. 11,929.)

B. The Tests at Linz and Their Results

Drs. Suess and Trenkler, employees of plaintiff VOEST in Linz, Austria, learned of the work at Gerlafingen, and Dr. Trenkler visited Gerlafingen in May of 1949 to find out more about the tests and their degree of success. VOEST at this time was contemplating reconstruction and expansion of steelmaking facilities damaged in World War II (R. 2222), and was therefore naturally interested in using successful new methods of steelmaking which [8] would not require the high capital expenditures necessary for construction of open hearth operations.

In June of 1949, Drs. Suess, Trenkler, Hauttmann and Rinesch began their own tests at Linz using oxygen in a converter, initially following the instructions of Drs. Durrer and Hellbruegge to blow vertically from above deeply into the bath. (R. 2659-60; DX 11B). The re-

sults in terms of phosphorus removal and refractory damage were initially worse than those achieved at Gerlafingen. However, in further June tests in which the impact pressure of the oxygen jet against the bath surface was reduced by a change in nozzle and an increase in lance height, the results showed satisfactory phosphorus removal without even the need for an afterblow, and also an absence of refractory damage. (See *infra* II. C (3).) Thus a satisfactory oxygen blowing process was achieved for the first time in June, 1949. Tests continued well into 1950 on a larger scale as preparation for commercial operations, which were put into production at Linz in November of 1952. (PX 342, p. 12.) The VOEST plant at Linz was the first commercial operation using the vertical oxygen blowing process perfected in the earlier Linz tests.

According to plaintiffs, more than 75% of all new steelmaking facilities constructed since 1954, or now in the planning stage, use the Linz process. (PX 342, p. 13.) Sixteen steel companies in the United States alone have either begun or planned facilities using the oxygen blowing process. (PX 104, p. 3.)[1] [9] In other parts of the world, sixty-four companies in twenty-three countries have installed the new oxygen steelmaking process or are now doing so. (PX 104.)

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1. Acme Steel Co.
Allegheny Ludlum Steel Corp.
Armco Steel Corp.
Bethlehem Steel Co.
Colorado Fuel & Iron Corp.
Ford Motor Co.
Great Lakes Steel Corp.
Inland Steel Co.
Jones & Laughlin Steel Corp.
Kaiser Steel Corp.
McLouth Steel Corp.
Pittsburgh Steel Co.
Republic Steel Corp.
United States Steel Corp.
Wheeling Steel Corp.
Wisconsin Steel Div. of International Harvester Co.

C. The History of the U. S. Patent Application

Dr. Suess, one of the VOEST employees responsible for the successful tests at Linz, filed patent applications with the Austrian Patent Office as early as January 31, 1950. (PX 2C.) He subsequently filed patent applications in his own name in other countries throughout the world. The original U. S. patent application was filed by Dr. Suess alone on January 16, 1951. (PX 2B.)

The original U. S. application contained 12 claims, directed to a ratio of bath depth to surface area favorable to circulation as the gist of the invention. These claims were four times rejected by the Patent Office, and the original application was finally abandoned in June of 1956 by failure to file a brief with the Board of Appeals in opposition to the Patent Office rejections.

Meanwhile, litigation between Dr. Suess and VOEST in Austria and Germany over the ownership of patent rights for the Linz process had been settled in October, 1955, with the result that VOEST became the owner of Dr. Suess' rights in the United States application and also his other applications and patents throughout the world. (DX 93B, p. 68; PX 3C.)

On November 16, 1955, a continuation-in-part application was filed by Dr. Suess in the United States Patent Office, containing a more detailed specification than the original application and also 15 new claims, the first four of which were directed [10] to the avoidance of deep penetration of the bath by the oxygen stream as the gist of the invention. (PX 2A.) All the new claims were rejected by the Patent Office on June 14, 1956, as unpatentable over prior art.

On December 7, 1956, in response to the Patent Office rejection of claims, the first ten claims were cancelled and the remaining five claims were resubmitted along with a new claim. On June 11, 1957, the pending six claims were cancelled by the applicant without waiting for Patent Office action, and two new claims were submitted. In May of 1956, after the death of Dr. Suess on March 4, 1956, Drs. Hauttmann, Trenkler and Rinesch had requested to be and were joined as inventors in the United States applications. Two of these men, Drs. Rinesch and Hauttmann, filed affidavits with the Patent Office on June 11, 1957, in support of the two new claims filed at the same time. No amendments to the specification were made at this time. The letter accompanying the new claims and the affidavits stated: "The new claims are presented in view of information recently made available and which indicates that the instant application discloses a fundamentally different approach to the refining of pig iron or crude iron by means of substantially pure oxygen than was suggested heretofore." (PX 2A, p. 74.)

A single amendment was made on June 18, 1957, to one of the new claims following a conference with the Patent Office Examiner. The patent application was allowed on June 27, 1957, roughly six and one half years after the original application had been filed, and only 16 days after the two new claims were filed. The patent was issued July 23, 1957.

[11] D. The Patent in Suit (Suess, et al., No. 2,800,-631) (PX 1)

The general subject matter of the patent in suit is described at col. 3, lines 16 to 27 of the specification:

> "The process of the invention generally comprises refining the molten metal in a converter type or other suitable vessel with a high purity oxygen jet impinging vertically or approximately vertically on the melt surface substantially at the central portion thereof by means of a blast nozzle or other suitable jet producing means under controlled conditions, hereinafter defined, to supply to the molten metal the required amount of oxygen for completion of refining within a predetermined time, and to produce autogenous heat sufficient to insure completion of the refining and adequate temperature in the refined charge for subsequent handling."

The specification then discusses general features of the process and gives a range of operating conditions at col. 3, line 37, to col. 4, line 5:

> "According to the process of the invention, the high purity oxygen jet is blown vertically, or approximately vertically upon the central portion of the surface of a bath of the molten metal, the jet having a diameter and static pressure at the point of origin, that is, at the blast nozzle or other jet producing means, and the point of origin (blast nozzle) being spaced from the bath surface, such that direct contact of the oxygen jet and the molten metal is established and maintained throughout the refining period without deep penetration of the

molten metal bath by the jet. In so operating, the area of jet impingement is controlled to produce a relatively confined zone of direct oxygen to molten metal contact with respect to the total surface area of the bath. It has been determined in application of the present invention to the refining of predominately molten pig iron charges by means of high purity oxygen, that the jet blown onto the surface of the molten iron, as above described, under a relatively low static pressure at the point of origin, for example, at the overhung blast nozzle, of from 5 to 25 atmospheres (about 75 to 375 pounds per square inch), preferably at about 8 to 12 atmospheres (about 115-175 pounds per square inch), with the jet diameter at the point of origin or blast nozzle being about 1 millimeter (1/25 inch) per ton of charge, and with the point of origin or blast nozzle spaced from the bath surface from at least 150 millimeters (about 6 inches) up to about [12] 2000 millimeters (about 80 inches), produces a sufficiently high reaction velocity of the oxygen with the bath constituents to insure the development of autogenous heat at a rate sufficient to provide the heat required for completion of the refining in a minimum of time, consistent with controlled temperature and control and development of other necessary and required process conditions, such as fluid slag, avoidance of over-oxidation (undue loss of iron to the slag), and avoidance of slopping. The process conducted under these conditions avoids a deep penetration of the oxygen gas into the molten bath which seriously impairs refractory life at the bottom of the refining vessel. In addi-

[11] D. The Patent in Suit (Suess, et al., No. 2,800,-631) (PX 1)

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molten metal bath by the jet. In so operating, the area of jet impingement is controlled to produce a relatively confined zone of direct oxygen to molten metal contact with respect to the total surface area of the bath. It has been determined in application of the present invention to the refining of predominately molten pig iron charges by means of high purity oxygen, that the jet blown onto the surface of the molten iron, as above described, under a relatively low static pressure at the point of origin, for example, at the overhung blast nozzle, of from 5 to 25 atmospheres (about 75 to 375 pounds per square inch), preferably at about 8 to 12 atmospheres (about 115-175 pounds per square inch), with the jet diameter at the point of origin or blast nozzle being about 1 millimeter (1/25 inch) per ton of charge, and with the point of origin or blast nozzle spaced from the bath surface from at least 150 millimeters (about 6 inches) up to about [12] 2000 millimeters (about 80 inches), produces a sufficiently high reaction velocity of the oxygen with the bath constituents to insure the development of autogenous heat at a rate sufficient to provide the heat required for completion of the refining in a minimum of time, consistent with controlled temperature and control and development of other necessary and required process conditions, such as fluid slag, avoidance of over-oxidation (undue loss of iron to the slag), and avoidance of slopping. The process conducted under these conditions avoids a deep penetration of the oxygen gas into the molten bath which seriously impairs refractory life at the bottom of the refining vessel. In addi-

tion, the impingement area of the high purity oxygen on the central portion of the bath isolates the refractory walls of the refining vessel from the extremely high temperatures which are developed by the direct reaction of the oxygen and the molten metal."

The specification discusses the movement of the bath during the major part of the blow at col. 4, line 26, to col. 5, line 5:

"Although it is not intended to limit the present invention to any specific theory of action or mechanism, it is believed that application of the oxygen jet substantially vertically or approximately vertically upon the central portion of the bath surface brings about a flow in the molten metal from the center of the surface of the bath downwardly and then along the bottom of the refining vessel, and upwardly at the sides of the vessel to the surface of the bath, so that portions of the unrefined metal are continuously presented to a localized center of direct oxygen reaction with the bath metal, while reacted or oxidized portions of the bath move away from this reaction center. This apparent circulation of the molten material is facilitated by shaping of the bottom of the device in its refractory lining in a uniformly curved design, preferably hemispherical or similar shape, so as to offer the minimum of resistance to the circulation.

"Due to the very high affinity of oxygen for iron, initial contact of the high purity oxygen jet with the molten metal bath causes a rapid combination of oxygen and iron to form FeO in the confined

central reaction zone. This is demonstrated by ignition of the oxygen and the propagation of a visible flame within the first minute of blowing. [13] This reaction, together with oxidation of impurity elements, such as silicon and manganese, develops extremely high temperatures in the zone of direct oxygen contact with the molten metal which approach the boiling point of iron, as demonstrated by the evolution of a fume containing iron oxide and manganese oxide. A portion of the iron oxide goes to the slag with the other oxidized elements and a portion diffuses into the bath under the influence of the bath circulation, so that within the first three minutes of the blowing vigorous carbon combustion is initiated due to the high temperatures developed by these reactions. The ensuing reaction of carbon with the FeO and directly with the oxygen gas in the confined direct oxidation zone causes rapid formation of carbon monoxide and the formation of this CO causes a strong boil or agitation of the bath, which augments the bath circulation to continuously present unrefined metal to the oxygen gas reaction zone and to create a slag-metal emulsion. The oxygen jet thus contacts the emulsion of bath and slag components which presents a larger reaction surface and causes the refining reactions to progress rapidly although the oxygen jet does not penetrate deeply into the molten metal bath and is confined to an impingement area at the central portion of the bath surface. This vigorous boiling action is opposed by the pressure of the oxygen jet only in the area of impingement, and outside of this area it represents primarily endo-

thermic reduction of FeO by carbon to form the evolved carbon monoxide, which reaction thus effectively encompasses the zone of direct oxygen reaction at which the highest temperatures prevail affording a maximum measure of protection to the refractory lining of the refining vessel."

The specification also teaches that an early fluid slag is obtained which promotes satisfactory removal of phosphorus and other impurities. Specifically, the patent states at col. 5, lines 60 to 72; col. 6, lines 5 to 25:

"As above mentioned, it is a characteristic of the process of the invention that in the confined zone of direct oxygen reaction at the surface of the molten metal bath, the oxidation products of the impurities in the pig iron, such as silicon and manganese, as well as the oxidized iron form an early fluid slag which is always very rich in oxides, that is, highly oxidizing. With the formation of the slag-metal emulsion, the iron oxide reacts with the [14] carbon present in the bath, primarily outside of the direct oxygen-metal reaction zone, and since such slag-metal reactions are endothermic, the molten bath is maintained cooler in the vicinity of the walls of the refining vessel or converter. * * *

"This formation of an early highly oxidizing fluid slag is of particular value in basic refining when the process is applied to pig iron of analyses used in ordinary open-hearth practice, which would not be amenable to refining by either the acid Bessemer process due to the phosphorus content, or the basic Thomas process due to the lack of sufficient

phosphorus. With the rapid heating of the slag cover and metal bath, the proper amounts of lime or lime supplying substance, such as limestone, may be added at the beginning of the blow and during the blow to insure formation and maintenance of a slag of sufficient basicity. Thus, the early fluid, basic and highly oxidizing slag formed provides an accelerated rate of phosphorus and sulfur removal from the bath, leaving the finished steel very low in both elements. With normal open-hearth pig irons having phosphorus contents ranging from about 0.1-0.35%, and even higher, e.g., 0.85% P, and with correct lime additions, final phosphorus contents not higher than about 0.025% and as low as 0.010% are obtained by the time the carbon end point is reached with only a single slagging operation."

With reference to conditions prevailing near the end of the blow, the specification states at col. 6, lines 62 to 74:

"The vigorous boil, above mentioned, continues up to the carbon end point, and together with the induced circulation of the bath metal toward and away from the central zone of direct oxygen reaction, effectively counteracts any tendency to overoxidation of the bath. When the flame dies and carbon combustion is completed, the bath becomes relatively quiet and intimate contact between slag and metal bath ceases. The turbulence of the bath and slag due to the oxygen stream impinging from directly above is insufficient to cause continuance of oxygen-metal reactions. As a result, steels blown by the process of the invention do not

suffer from the deteriorating effects of high oxygen (FeO) contents."

The specification then gives specific details of an [15] exemplary commercial practice of the process, admittedly (Defendant's main brief, pp. 156, 170) based on experience at the VOEST plant in Linz, Austria, at col. 8, line 72, to col. 9, line 24:

"In actual practice, based on experience in operation of 30 ton converters, oxygen feed rates may be maintained such that depending upon pig iron analysis, amount of scrap addition and desired finished steel analysis, the refining to usual carbon end points on the order of 0.05% C is completed in from about 15 to about 30 minutes, preferably 18 to 22 minutes. Flow rates of from about 4000 to 8000 cubic meters of oxygen per hour are representative of the oxygen input under these conditions.

"In such exemplary commercial practice with 30 ton converters charged to 35 to 36 tons, oxygen pressures at the blast nozzle of about 8 to 10 atmospheres and oxygen jet or blast nozzle diameters of from 27.5 to 35 millimeters (1.1 to 1.4 inches) with nozzle spacings varying from 25 to 50 inches (about 650 to 1250 millimeters have been used, the preferred spacing being from 30 to 40 inches (about 750 to 1000 millimeters). In general, it may be stated that as the oxygen pressure and nozzle diameter are increased, the nozzle spacing is also increased, for example, as the capacity of the refining vessel and total charge is increased. Under these conditions, deep penetration of the molten

metal bath is avoided, while the necessary displacement of the slag cover to maintain direct oxygen to molten metal contact is insured. However, in the unusual circumstances of an abnormally stiff slag cover, the blow may be initiated using mechanical means for penetrating the slag cover to establish oxygen to metal contact."

The specification continues with typical illustrations in col. 9 of the chemical composition of steels produced from various types of pig iron according to the process of the specification; also in col. 10 with "a detailed description of a typical operation of the process."

The patent concludes with two claims reading as follows [16] at col. 12, lines 10 to 33:

"1. Method of refining molten impure iron in the presence of a slag in a vessel having a refractory lining by blowing with oxygen, which comprises discharging a stream of oxygen vertically downwardly through the slag layer onto and below the surface of the bath at the central portion thereof, to an extent to avoid material agitation of the bath by the oxygen stream, the contact of the oxygen with the bath resulting in reaction of the oxygen with a portion of the iron and with the oxidizable impurities of the bath in a localized reaction zone spaced a substantial distance from the refractory lining, the reactions in said zone resulting in refining of the iron and gas evolution and in the production of high temperature in the reaction zone away from the refractory lining, said reaction producing a circulatory movement in the molten metal, which circulatory movement brings those portions of the

molten metal bath which are remote from the reaction zone into the reaction zone whereby those portions are subjected to said reaction with minimum injury to the refractory lining.

"2. The gaseous oxygen process set forth in claim 1 in which the oxygen is blown into said vessel under pressure in a range between five and about twenty-five atmospheres above normal atmospheric pressure."

E. The Licensing Structure of the Patent in Suit

In the early 1950's, VOEST and several other European steel companies were concerned with the use of oxygen in steelmaking and held or sought patents on various inventions relating thereto. According to plaintiffs:

"In order to resolve any conflicting claims which might have arisen as between VOEST and OAM, on the one hand, and the Brassert group, on the other hand, and in order to achieve the best and widest possible utilization of the various inventions relating to this new process throughout the world, the exploiting firm of BOT was formed."

(Plaintiffs' main brief, p. 446.)

On May 9, 1952, VOEST and Oesterreichisch-Alpine Montagesellschaft (OAM) [17] another Austrian steel company, entered into an agreement with BOT under which BOT was to have the exclusive right to exploit commercially the various inventions owned by the parties. (PX 4B.) Thus BOT obtained the right to exploit any patents VOEST might acquire on the oxygen blowing process developed at Linz in 1949. BOT also ac-

quired exclusive licensing rights in the Schwarz, Miles and Mannesmann patents in 1952. (PX 9B, 9I and 9E.) In effect, BOT became the exclusive licensing agent all over the world for a so-called pool of patent rights relating to the use of oxygen in steelmaking.

On May 20, 1954, BOT and Kaiser entered into an agreement by which Kaiser became, in effect, the exclusive licensing agent for BOT in the United States, with the right to sue for patent infringement. (PX 5B.) Pursuant to this agreement, Kaiser has since given package license agreements to a number of steelmakers in this country. (PX 7B, 7C, 7D, 7E, 7K, 7M, 92-3.)

Thus, when the patent in suit was granted to VOEST in 1957, BOT and therefore Kaiser acquired the exclusive right to grant licenses under the patent in the United States, and to sue for infringement as in the instant case.

F. The History of Defendant's Operations

In 1953, defendant McLouth desired to expand its steelmaking facilities and was, therefore, receptive to new methods which might produce steel of the desired high quality at lower cost than open hearth operations. McLouth learned of the new process being used at Linz, and therefore sent one of its officers, Mr. Lindberg, to Linz to observe the new process. McLouth also got further information about the Linz process from Kaiser, [18] and on November 12, 1954, McLouth and Kaiser entered into an agreement for Kaiser to give know-how engineering knowledge and consultation services concerning the process to McLouth at a cost of $100,000. (PX 37K.) As a result, McLouth, without further ex-

perimentation of its own (R. 3507), constructed its OP-1 steelmaking shop consisting of three vessels or converters, the design of the operation being copied from the one at Linz. (R. 1283-88, 3513-16, 3525-29, 3540-41, 3573-80, 3447-51, 3490-91, 3507-08.) The OP-1 shop commenced commercial operations on December 19, 1954. In 1955, Dr. Rinesch, later a patentee of the patent in suit, visited the McLouth operation at Trenton and gave constructive advice as to the workings of the operation.

McLouth's decision "to integrate the Austrian process into its steelmaking operations" (PX 98D) resulted in substantial savings and improvements in production. In the OP-1 operation, capital costs of construction were estimated to be $10.00 per annual ton (R. 3458-63), as compared with capital costs of $30.00 to $45.00 per annual ton for an open hearth shop in 1953 (R. 3459), and operating cost savings on the OP-1 shop were about $3.00 per ton. (PX 98D.) Further, Mr. Lyle J. Johnson, McLouth's Vice-President of Engineering, testified that in 1953 the average production per hour in the OP-1 shop was 60 to 65 tons (R. 3468-69), as compared with an average production of 21 to 25 tons per hour in an open hearth operation. (R. 3467-68.) McLouth admits that, by the oxygen process, steel is made "in one-fourth the usual open hearth time." (PX 98C.)

McLouth interpreted the know-how agreement with Kaiser as a license to use the Linz process. However, Kaiser interpreted the agreement as giving McLouth merely an option to take [19] a license, and therefore eventually brought suit against McLouth for patent in-

fringement on July 19, 1957, four days before the patent in suit was issued. On August 29, 1958, the complaint was amended to allege infringement of the patent in suit.

McLouth continued to manufacture steel successfully in the OP-1 shop, and also expanded its operations with the construction of two vessels in another shop, known as OP-2, in 1958, and adding a third vessel to the OP-2 shop in 1960.

The issue whether the know-how agreement of November, 1954, constituted a license agreement or merely an option to take a license was raised by cross motions for summary judgment, resolved by this Court in favor of Kaiser. 175 F. Supp. 743 (D.C. Mich. 1959.) The Court's holding was affirmed on an interlocutory appeal by an opinion of the Sixth Circuit Court of Appeals, dated March 28, 1960 (277 F. 2d 458). The appellate court's affirmance that the November, 1954, agreement did not give McLouth a license under the patent in suit set the stage for a trial on infringement of the Suess, et al. patent. Naturally, the interlocutory appeal necessitated some delay in bringing the suit for infringement to trial.

G. The Issues in This Case

McLouth has raised the standard defenses in a patent case of invalidity and noninfringement. More specifically, with regard to validity, McLouth has contended that the patent in suit is anticipated by prior art, in particular, the Schwarz and Miles patents; also that the process of the patent was obvious to a person skilled in the art at the time the invention was made;

and, further, that plaintiffs did not themselves invent [20] the process, having learned the process from Dr. Durrer and Dr. Hellbruegge of Gerlafingen, Switzerland. McLouth further contends that neither the specification nor claims of the patent comply with the requirements of 35 U.S.C. § 112 relating to definiteness. Defendant denies infringing the process as stated in the claims of the patent, although it does not contest the allegation that it is using the process disclosed by the specification.[2] The basis for this position is McLouth's contention that the claims are not supported by the specification.

Additionally, McLouth asserts that the patent is unenforceable because of an alleged antitrust violation and consequent patent misuse arising out of the licensing structure and practices of the so-called patent pool controlled by plaintiff BOT. In essence, defendant contends

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2. Defendant admits that the process disclosed in the specification of the Suess patent in suit is the same as the process in use at the VOEST plant in Linz, Austria. (Defendant's main brief, pp. 156, 170; reply brief, pp. 12-13.) Defendant further admits that the Linz process is essentially the same as the process in use at the McLouth plant in Trenton, Michigan. (See R. 126; PX 98D.) For example, on final argument, counsel for defendant stated: "We do not contest that basically, fundamentally, the Linz process, as practiced, and the McLouth process — and I may add every other oxygen blowing process of which we have any knowledge — follows the same general method." (R. 13,487; see also R. 13,819.) and in its reply brief, defendant stated: "McLouth has never contested the fact that all oxygen blowing of a practical or commercial nature — and the 'exemplary commercial practice' of the patent is understood to be the Linz practice—is basically similar." (pp. 12-13.)

that the accumulation of a large number of patents in the hands of plaintiffs, Kaiser in the United States, and BOT in Europe and the rest of the world, partly as the result of grant-back provisions in licenses by plaintiffs, constitutes an antitrust violation.

[21] **II. THE QUESTION OF VALIDITY**

With respect to validity, it must first be noted that according to 35 U.S.C. § 282: "A patent shall be presumed valid. . . . The burden of establishing invalidity of a patent or any claim thereof shall rest on the party asserting it." Thus the burden of proof is upon McLouth in this case to establish the invalidity of the Suess patent in suit No. 2,800,631. In this connection, the Sixth Circuit Court of Appeals has commented on the weight of such a burden as follows: " . . . one otherwise an infringer who assails the validity of a patent fair upon its face bears a heavy burden of persuasion, and fails unless his evidence has more than a dubious preponderance." *Williams Mfg. Co. v. United Shoe Mach. Corp.*, 121 F. 2d 273, 277 (CA 6, 1941), quoting from *Radio Corporation of America v. Radio Engineering Laboratories, Inc.*, 293 U. S. 1, 8 (1934).

A. Anticipation

35 U.S.C. § 102 provides in pertinent part:

"A person shall be entitled to a patent unless—

(a) the invention was . . . patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for patent, or

(b) the invention was patented or described in a printed publication in this or a foreign

> country . . . more than one year prior to the date of the application for patent in the United States, . . ."

According to the pretrial order in this case, McLouth relies on three foreign patents as anticipation of the patent in suit or as showing the state of the art: the Schwarz German patent No. 735,196 dated July 3, 1943; the Miles Belgian patent No. 468,316 dated March 1, 1947; and the Potts British patent No. 623,881 dated May 24, 1949. However, in the opening statement and also [22] in the final briefs and arguments, McLouth relied only on the Schwarz and Miles patents as pertinent prior art, ignoring the Potts patent almost entirely. (R. 143-44; defendant's main brief, p. 212; reply brief, p. 27). For example, when asked by the court on final arguments: "Do you concede that the Schwarz and Miles patent would be the most pertinent prior art?", counsel for defendant replied: "Certainly the most pertinent patents, yes, your Honor, very much. They are the ones on which we primarily rely. There is a lot of other prior art, to some of which peripheral attention was given and which is interesting from one point or another; but these are the two patents upon which so far as the patented art is concerned McLouth relies." (R. 13,707.) Therefore, the first issue before the court on validity is primarily whether the patent in suit was anticipated by the Schwarz or the Miles patent.

With regard to what must be proven to establish anticipation by prior art as a defense under § 102, the law is clear. Initially, it must be noted that further statutory language in § 103 makes clear that an invention must be "identically disclosed or described" in a

prior art reference for the defense of anticipation to arise under § 102. Further: "In order to anticipate an invention, it is necessary that all of the elements of the invention or their equivalents be found in one single description or structure, where they do substantially the same work in substantially the same way." *Aluminum Co. of America v. Sperry Products, Inc.*, 285 F. 2d 911, 917 (CA 6, 1960). Even more significantly in this particular case: " 'A foreign patent is to be measured as anticipatory, not by what might have been [23] made out of it, but by what is clearly and definitely expressed in it. An American patent is not anticipated by a prior foreign patent, unless the latter exhibits the invention in such full, clear, and exact terms as to enable any person skilled in the art to practice it without the necessity of making experiments.' " *Aluminum Co. of America v. Sperry Products, Inc., supra,* at 922. Accord, *Allied Wheel Products v. Rude,* 206 F. 2d 752, 759 (CA 6, 1953).

Thus the issue of anticipation before the court, precisely stated, is whether McLouth has carried its heavy burden of showing that either of the Schwarz or Miles foreign patents alone identically disclosed the invention of the patent in suit in such full, clear and exact terms as to enable persons skilled in the art to practice the invention without making any further experiments.

(1) THE SCHWARZ PATENT

The Schwarz German patent (DX 61, Schwarz) teaches and claims a process of refining pig iron into steel by directing a jet of oxygen-enriched air or pure oxygen "onto the surface of the bath with such a high kinetic energy that it is capable of penetrating in the manner of a solid body deep into the bath by the use of

extremely high velocities lying preferably above the speed of sound." (DX 61, Schwarz, p. 2.) The teachings of the patent are stated in general language, and the patent does not teach specific operating conditions, such as an acceptable range of oxygen blowing pressures, flow rates, lance heights, bath depths and widths or nozzle diameters. Neither does the patent specify whether the oxygen jet is to be directed vertically downward against the bath or at an angle less than a right angle. [24] No exemplary conditions are given.

According to Dr. John Chipman, a professor emeritus of metallurgy and former head of the department of metallurgy at Massachusetts Institute of Technology, who testified for plaintiffs, the Schwarz patent does not teach a practical operating process. (R. 1019.) Defendant McLouth argues to the contrary, relying on testimony of Dr. Richard A. Flinn, a professor of metallurgical engineering at the University of Michigan, who testified for defendant. However, Dr. Flinn admitted that the Schwarz patent, unlike the patent in suit, does not teach specific operating conditions. (R. 8158-60, 8184-88.) Dr. Flinn also testified that the Suess patent in suit does not teach a practical operating process, except for the exemplary condition, because insufficient directions are given in the specification as to the proper operating conditions for heats of larger or smaller size than the 35 ton exemplary heat. (R. 7885.) Clearly, if Dr. Flinn thought that the patent in suit was too indefinite, although it contains far more specific and detailed information about operating conditions than the Schwarz patent, he could not have seriously contended that the Schwarz patent was sufficiently definite to teach

a practical operating process or to anticipate the patent in suit.

According to Dr. Durrer, a pioneer experimenter with oxygen in steelmaking, who testified at the trial, Schwarz' work never led to any practical results for commercial steelmaking. (R. 5085.) There is no evidence in the record to the contrary. Defendant relies on the fact that the Mannesmann Company in Germany took a license under the Schwarz patent in 1952, but there is no evidence that Mannesmann ever made satisfactory steel on the basis of Schwarz' teachings. Dr. Durrer [25] also testified that the Schwarz patent contained his own ideas (R. 5101; PX 301-A), yet Dr. Durrer himself required further experimentation with oxygen blowing in Gerlafingen, Switzerland in 1948 and 1949, and even with such experimentation, he did not make steel comparable to that made in Linz by the patentees starting in June of 1949. (See *infra,* II, c. (3).) The patentees tried to follow the teachings of Schwarz and Durrer in a series of tests starting June 17, 1949, but failed to get good results, requiring further experiment in a series of tests starting June 25, 1949, to get satisfactory phosphorus removal without refractory damage. (See *infra,* II, c. (3).) In this connection, the recent statement of the United States Supreme Court in *United States v. Adams,* 383 U. S. 39, 50 (1966), that an inoperable prior art reference does not negative novelty, is applicable.

There is also considerable evidence in the record that the teachings of the Schwarz patent cannot, in fact, lead to good results in steelmaking because the early fluid slag required for satisfactory phosphorus

removal according to the specification of the Suess patent in suit is not achieved with deep penetration of the bath by the jet, as taught by Schwarz. As Dr. John Elliott, a professor of metallurgy at the Massachusetts Institute of Technology, a witness for plaintiffs, testified at R. 6170:

"Q. And what effect does the deep penetration of the oxygen jet have on the slag that prevents this adequate control of phosphorus and sulphur that you were referring to?

"A. If the oxygen enters deeply into the bath, there is too little oxygen available where the slag is formed and this prevents the slag from being fluid, it keeps the iron oxide content low. The operator would say he had a dry slag.

"Q. Is a dry slag good for phosphorus removal?

"A. No. It is neither fluid nor highly oxidizing."

[26] (Also see *infra*, II. C (3).)

Defendant's witnesses admit that a deep penetration of the bath by the jet prevents satisfactory phosphorus removal. Mr. Johnson, for example, testified as follows (R. 3483-85):

"Q. It is true, is it not, Mr. Johnson, that during at least the early part of the blow and for a substantial portion of the blow, it is necessary to operate with the lance in what would be termed a high position in order to enable you to get rid of the phosphorus?

"A. To be more specific, it is necessary to melt some of the slag from constituents as early as possible, and the higher lance position would assist in doing that.

"Q. You have to have, as you put it, a higher lance position in order to enable you to get a fluid slag early in the operation in order to enable you to adequately get rid of the phosphorus. Is that a fair statement?

"A. We want to melt some of the slag from constituents as soon as possible so that phosphorus reduction can start.

"Q. And the way that you do that is by utilizing a high lance position at the outset?

"*Mr. Groner*: 'High' being used relatively?

"*Mr. Webb*: Yes.

* * *

"Q. As a matter of fact, it is true, is it not, that the reason why you operate at the higher lance level in the earlier portions of the blows in your No. 1 and No. 2 Shops than you do later on in the blow is because you want to get the fluid slag so that you can get the phosphorus removal. Right?

"A. Partly, and also partly because the height of the material in the vessel is higher at that time.

* * *

"Q. Shall we say, then, that that is one factor, but that the principal reason for operating [27] at the higher lance position throughout a substantial portion of the blow, and particularly at the earlier stages of the blow, is that you want to get a fluid slag so that you can get rid of the phosphorus?

"A. The intention in the operation is to start melting some of the slag as soon as possible, yes.

"Q. And for what purpose then?

"A. So that phosphorus reduction will start.

"Q. How long does that phosphorus reduction continue?

"A. Depending on the temperature of the slag, it can continue during the entire heat or stop and start.

"Q. As a matter of fact, it is important that you do get rid of the phosphorus, or as much of it as you can, in your operation because of the fact that your customers require low phosphorus in the steel in order that it will have the properties desired by them?

"A. Yes."

Also, the testimony of Mr. Horsley, McLouth's General Superintendent of the Hot Metals Division, is significant in this regard. Specifically, he testified (R. 6692-93):

"Q. Yes. And during the course of the blow, on occasions the lance height was lowered. What is the reason why that lance is lowered during the course of the blow?

"A. Normally, we will start a blow with an elevated lance position to flux the slag. After the foreman feels the slag is fluxed, he will start lowering his lance, increasing the flow, or one or the other, and that is to achieve penetration of the metal.

* * *

"Q. There are occasions when the lance is raised during the course of the blow. What is the purpose of raising the lance during the course of the blow?

"A. I remember one heat in particular on the days you were there that the lance was raised, [28] and that particular heat, I don't recall the heat number, was due to a dry slag.

"Q. Well, from time to time in the regular operations on other occasions, they do raise the lance, do they not?

"A. It will happen if they need to flux or make their slag a little thinner; and also it will happen on a heat where they stop a blow on a higher carbon, they raise the lance to flux the slag just before they shut off the oxygen.

"Q. And the purpose in that instance is what?

"A. To thin the slag.

"Q. And what does the thinning of the slag do?

"A. Build up the FeO in the slag.

"Q. And for what purpose?

"A. For phos reduction.

"Q. The higher lance positions are necessary during the operation in order to enable you to get a good, thin slag which will enable you to remove the phosphorus?

"*Mr. Groner*: You mean in all operations or the particular ones that he was just refering to where the lance was raised?

"*Mr. Webb*: In all operations.

"A. Mr. Webb, our intent is to start the blow at an elevated lance position in order to build up the

FeO in the slag in order to have a thin slag, then decrease the lance position or lower the lance and increase the flow to penetrate the bath after the slag has been fluxed. It is true you need a fluid slag for phos or sulphur reduction.

"Q. And the way you get that, as I understand your testimony, is by this higher lance position?

"A. That is our method of getting it."

The testimony of Mr. Johnson and Mr. Horsley is consistent with the teaching of the specification at col. 6, lines 5 to 19, concerning the desirability of an early fluid slag for [29] satisfactory phosphorus removal. The specification of the patent in suit also teaches the avoidance of deep penetration, in contradiction to the teachings of the Schwarz patent, and, further, the specification of the patent in suit at col. 3, lines 70-75, associates the avoidance of deep penetration with the fluid slag necessary for satisfactory phosphorus removal. The Schwarz patent teaches nothing about the necessity of a fluid slag for phosphorus removal or its connection with the avoidance of deep penetration. Thus the teachings of the patent in suit are certainly not "identically disclosed or described" by the Schwarz patent.

In view of the unspecific teachings of the Schwarz patent and its lack of detail concerning operating conditions, as well as the apparent inability of steelmakers including Dr. Durrer and the patentees to make satisfactory steel following the ideas of the Schwarz patent, it cannot be said that the Schwarz patent teaches the invention disclosed in the patent in suit in such full,

clear and exact terms as to enable persons skilled in the art to practice the invention without further experiment. Moreover, the Schwarz patent does not teach the invention claimed in the Suess patent. Schwarz teaches nothing about the avoidance of material agitation of the bath by the oxygen stream or a circulation of the bath produced by chemical reactions in a localized reaction zone, as claimed by the patent in suit. The conclusion is therefore, inescapable that the patent in suit is not anticipated by the Schwarz patent under 35 U.S.C. § 102.

(2) THE MILES PATENT

The Miles Belgian patent (DX 61, Miles) teaches a process of blowing fluid containing from 70% to 98% oxygen (DX 61, Miles, p. 2) downwardly into a bath of molten pig iron. [30] preferably at an angle between 30 and 75 degrees (p. 17), so that the major part of the fluid jet penetrates into the bath (p. 3), serving to circulate and agitate the metal and slag. (p. 18.) The gist of the invention appears to be the teaching of blowing upon the surface of the metal at a velocity which is sufficiently high to assure the penetration of almost all the fluid into the bath, so as to react with the oxidizable impurities of the metal and eliminate them. (pp. 2, 20). According to the patent: "The course of the refining can be controlled by varying the inclination of the jet with respect to the surface or by varying the velocity of the gases or their composition." (p. 4.) In a specific example, the Miles patent teaches the use of a nozzle of 0.32 inches inside diameter, operated at an oxygen pressure of 7 or 8 atmospheres and spaced 6 inches above the surface of a molten metal bath, to obtain the desired penetration of the bath by the jet. (p. 3.) The invention of the Miles patent is applied in its specification to the

Bessemer process in various manners; thus, in effect, a variety of steelmaking processes are suggested in the specification. For example, the specification suggests the use of a normal basic Bessemer blow "until the end of the carbon flame period after which the converter is tipped downward, the air feed is cut off and a high speed jet of oxygen and nitrogen in liquid or gaseous state is projected in order to oxidize the remaining impurities." (p. 5.) In another example, the patent states that "It becomes needless to provide the Bessemer with the usual bottom if the high speed jet is injected into the bath of molten metal through one or more tuyeres, the nozzles of which are located a few inches above the surface of the metal bath." (p. 7.)

[31] It cannot be said that the teachings of the Miles patent identically disclose the invention of the Suess patent in suit in such full terms as to enable persons skilled in the art to practice the invention without further experiments.

In the first place, the teachings of the Miles patent are tentative and leave open a number of possibilities, some of which are recommended over others. Certain of the operating conditions of the patent in suit are included within the broad range of possibilities taught by Miles, but are not necessarily recommended by Miles. Thus Miles teaches that "The jet is established at any angle between 15° and 90° with respect to the horizontal, but preferably between 30° and 75°, while the distance from the jet to the metal and/or the slag should be between 1 and 20 inches, preferably between 4 and 12 inches." (p. 17.) In contrast, the patent in suit teaches and claims only vertical blowing, which is not recommended by Miles, and also teaches a range of

nozzle bath distances from 6 to 80 inches, which only partially overlaps the range of distances taught or recommended by Miles. Further, the patent in suit teaches and claims only the use of pure oxygen gas, but Miles teaches the use of an "oxidizing fluid" which may be either liquid or gas and which may contain as much as 30% nitrogen. (p. 2.) Miles appears to recommend the use of liquid rather than gas by stating: "one of the advantages afforded by the use of a liquid instead of a gas for the jet is that the liquid has a greater force of penetration into the metal; if desired, therefore, the projecting tuyere can be maintained at a greater distance from the metal. Another advantage results from the fact that the oxygen-nitrogen [32] mixture is produced in liquid state during normal manufacture and can be transported and stored more economically than a gas." (p. 2.) Miles also apparently recommends a certain percentage of nitrogen in the fluid used. Thus the patent states: " . . . it has been found that it is too costly to employ a fluid containing more than 98% oxygen so that in effecting the present invention, the relation of nitrogen to oxygen in the refining fluid has been kept between 30/70 and 2/98. The preferred percentage of nitrogen is between 5% and 25% . . . " (pp. 4-5.)

In sum, a person skilled in the art would have to depart from the recommendations of the Miles patent in respect to blowing angle, blowing distance, the use of liquid rather than gas and the chemical composition of the oxidizing fluid in order to arrive at the teachings of the patent in suit. Although the patent teachings of vertical blowing pure oxygen gas from a distance of at least six inches are not expressly precluded by the teachings of the Miles patent, a person skilled in the

art, starting with the Miles patent, would certainly require considerable further experiment to arrive at such teachings of the patent in suit in order to practice the invention. The differences already mentioned between the Miles patent and the patent in suit are alone sufficient to dispose of the contention of anticipation by Miles.

In addition, Miles' suggestions of a variety of processes, including examples using more than one jet, would require a person skilled in the art reading the Miles patent to experiment with the various suggestions to determine which, if any, are satisfactory.

[33] Moreover, the Miles patent does not contain certain essential teachings of the patent in suit, and indeed contains teachings inconsistent therewith. For example, Miles teaches that the major part of the jet penetrates into the bath (p. 3), serving to circulate and agitate the metal and slag. (p. 18.) The patent in suit, on the other hand, claims a process which avoids material agitation of the bath by the jet and includes a circulation caused by chemical reactions rather than the action of the jet. Further, the patent in suit teaches the avoidance of a deep penetration into the bath by the oxygen jet (e.g., col. 3, line 74.) In general, the teachings of the Suess patent concerning operating conditions are more specific and detailed than those of Miles. For example, the patent in suit (at col. 3, lines 56-7) teaches a range of blowing pressures from 5 to 25 atmospheres of pressure, but Miles contains no such teaching. Additionally, in col. 10, the patent in suit teaches an exemplary operation in great detail concerning the quantity and composition of pig iron and scrap used and slag material added, blowing pressure and

nozzle diameter, nozzle bath distance, blowing time, oxygen consumption and efficiency, and chemical composition of the steel produced. Miles teaches no such detailed example producing satisfactory steel.

According to Dr. Durrer, Miles' work led to no practical results in steelmaking (R. 5085), and Dr. Chipman testified that the Miles disclosures did not describe a practical operating method for making steel. (R. 1019.) There is no evidence in the record to the contrary. In fact, there is admittedly no evidence in the record that steel of the quality now produced at [34] Linz and at the McLouth plant in Trenton, Michigan, was produced anywhere in the world by an oxygen top blowing process prior to June of 1949. (R. 13,484-86.) Dr. Durrer and Dr. Hellbruegge were familiar with Miles' work, and yet even with further experimentation consisting of more than 100 heats by the spring of 1949, they apparently failed to produce steel comparable in quality to that produced in Linz (See *infra*, II, C (3).) Moreover, the patentees were admittedly familiar with the Miles patent in early June of 1949 (DX 116, p. 2; DX 117, p. 2), but the patentees also required further experimentation to produce satisfactory steel. It is true that heats No. 21 to 24 of the June, 1949, tests at Linz, which produced good steel, used a nozzle diameter, blowing pressure and nozzle bath distance almost identical with the example suggested by the Miles patent. (See DX 116-A.) However, the example of the Miles patent mentioned a jet speed of 1250 feet per second, somewhat faster than the speed of sound. (DX 61, Miles, p. 3.) Such a supersonic speed of the jet would require the use of a so-called Laval nozzle (R. 2863-67), and therefore the fair implication of the teaching of a supersonic jet

speed by Miles is the teaching of the use of a Laval nozzle. The Miles patent also states that lower speeds can be used, but does not expressly approve even subsonic speeds for purposes of the example. The patentees used a normal nozzle rather than a Laval nozzle in their heats 21 to 24, which otherwise followed the teachings of the Miles example. (DX 116-A.) According to the Rinesch affidavit, the use of the normal nozzle resulted in a subsonic jet speed of 280 meters or roughly 919 feet per second (DX 116, p. 4), over 300 feet per second slower than the speed [35] suggested by Miles. This difference in jet speed would materially reduce the impact pressure of the jet and therefore the penetration of the jet into the bath. Such a difference in penetration is consistent with the difference in teaching between the Miles patent and the Suess patent with regard to penetration. Although Miles does not expressly teach "deep penetration", as does Schwarz, it is agreed that Miles' teachings are essentially the same as Schwarz' and that a person following Miles' teachings will obtain a deep penetration of the bath by the jet (e.g., R. 107-08). The patent in suit, on the other hand, teaches the avoidance of deep penetration, and the record indicates that such avoidance of deep penetration is in fact the gist of the invention by the patentees. (See *infra,* II B (2); II E (1).)

In addition to the absence of proof in the record that persons skilled in the art following Miles' teachings were able to make satisfactory steel, there is also the affirmative evidence that deep penetration as taught by Miles cannot in fact lead to good results in steelmaking, because the early fluid slag necessary for adequate phosphorus removal is not formed with a deep penetration

of the bath by the jet, as already discussed in connection with the Schwarz patent.

In short, the Miles patent cannot be said to anticipate the patent in suit for a number of reasons: the patent in suit contains specific and detailed operating conditions and teachings either not found in Miles or not recommended by Miles, or contradicting the teachings of Miles; and, further, the evidence in the record indicates that Miles' teachings did not and indeed could not lead to good results in steelmaking comparable to those achieved by the patentees.

[36] (3) THE POTTS PATENT

Since defendant has apparently withdrawn its reliance on the Potts British patent (DX 61, Potts) as anticipating the patent in suit, a lengthy discussion of this patent is unnecessary. Potts teaches that "The jet is preferably directed onto the surface of the metal at an angle," and that "The jet device is usually placed in the furnace in such manner that the nozzle is approximately at the slag surface or slightly submerged therebelow, although good results have been obtained with the nozzle placed approximately 3 to 6 inches above the slag surface. The oxygen jet, when at a velocity above sonic speed, tends to penetrate the slag and metal and to form a well-defined cavity or recess in the surface of the molten metal." (DX 61, Potts, p. 3.) Clearly the essence of Potts' teaching is inclined blowing at supersonic speed, resulting in a deep penetration of the bath by the jet. Such teaching does not anticipate a teaching of vertical blowing from at least 6 inches above the bath, so as to avoid deep penetration of the bath by the jet. Further, Potts does not teach the range of operating

conditions of the patent in suit, nor is there any evidence that Potts' process led to any practical results in steelmaking.

(4) CONCLUSION

On the issue of anticipation by prior art, defendant's position has shifted several times in the course of this litigation. As already noted, the pretrial order stated as a defense anticipation of the patent in suit by the Schwarz, Miles and Potts patents. On the opening statement, defendant stated a defense of "no invention over Schwarz and Miles," a vaguely [37] worded defense which could include either lack of novelty under § 102 or obviousness under § 103. However, on opening statement, counsel for defendant continued, stating:

> "Mr. Webb adverted yesterday to the fact that we did not claim that Schwarz and Miles blanketed or anticipated the patent in suit. Of course not. They were practical men with a practical method of operation. They taught oxygen blowing as it is practiced. They weren't compelled to resort to the subterfuges of the patent in suit. They didn't have any absurdities about the avoidance of material agitation. So there are differences between the patent in suit and Schwarz and Miles.
>
> "But to the extent that the patent in suit departs from Schwarz and Miles it is pure phoney, non-practiced, non-known, in any commercial operation in the world." (R. 143-44.)

This statement appears to have been a waiver of any defense of anticipation by Schwarz and Miles.

On final arguments, the Court expressed some confusion as to whether defendant was relying on anticipation or obviousness, stating:

> "I don't know for sure—I haven't heard, of course, from the defendants—but after reading the briefs, I got that impression; that their main thrust here is more that this was, in fact, anticipated by Schwarz and Miles and the teachings of Durrer and Hellbruegge, rather than admitting that this is some advance in the art and yet it doesn't arise to the level of invention."

Counsel for defendant then expressed agreement with the Court's statement, so as to give the impression defendant was relying on a defense of anticipation after all. (R. 13,161-2.) This impression was strengthened (R. 13,409) when counsel for defendant stated that plaintiffs' "operation, so far as it is known in commercial exemplification, is simply and solely what was known before them by Schwarz and by Miles." The Court then asked counsel for defendant: "Well, now, in view of that statement, [38] is it your position that the patent in issue is anticipated by Schwarz and Miles?" and counsel answered: "If it please your Honor, we proved defenses under Section 102 and under Section 103."

However, shortly thereafter the following colloquy occurred:

> "[*Counsel for defendant*]: Our defense has been largely built around the defense of Section 103, that no invention is shown in the patent in suit over the prior art. We have done that despite having pleaded that it was anticipated because of the ex-

crescences on the patent that are not duplicated in the prior art.

"*The Court*: Well, now, there is a difference between anticipation and whether there is invention over the prior art.

"[*Counsel*]: Yes, your Honor; I recognize it.

"*The Court*: Now, which do you rely on?

"[*Counsel*]: We rely on section 103, if it please your Honor, that there is no invention.

"*The Court*: The test of invention.

"[*Counsel*]: Yes, sir.

"*The Court*: You are not relying on anticipation, then?

"[*Counsel*]: Not specifically." (R. 13,409-10.)

At R. 13,710, the Court once again asked counsel for defendant: "Do you contend Schwarz and Miles anticipate Suess?" and counsel answered: "No, your Honor, because in the patent in suit there are these erroneous fictitious statements about avoiding deep penetration and that sort of thing, which are just the contrary of Schwarz and Miles. Actually I think it is true that the patent in suit adopted that talk about the avoidance in order to try to keep Schwarz off their neck."

Defendant's briefs after trial are unclear whether anticipation or obviousness is urged as a defense, almost to the [39] point of being deliberately vague. Thus defendant's main brief argues: "Efforts to differentiate the patent from the prior art Schwarz and Miles patents get nowhere because the patent is silent on the

points of asserted difference. The patent in suit is invalid over Schwarz and Miles." (p. 223.) Defendant's reply brief argues: "The patent in suit, stripped of its inaccuracies, and disregarding its unresolvable ambiguities, is undistinguishable from the Schwarz and Miles patents. The patent discloses no invention over Schwarz or Miles and is invalid." (p. 40.)

The Court might justifiably have relied entirely on defendant's statements at R. 143-44, 13,410 and 13,710, waiving any defense of anticipation by prior art. However, in view of defendant's somewhat ambivalent attitude concerning this defense, the Court felt obliged to decide the issue on the evidence. As already discussed, it is the opinion of this Court that defendant has not carried its heavy burden of showing that either the Schwarz or Miles patents alone identically disclosed the invention of the patent in suit in such full, clear and exact terms as to enable persons skilled in the art to practice the invention without further experiment. In other words, the Court finds that the patent in suit is not anticipated by prior art.

B. Nonobviousness

In 1952, Congress enacted Section 103 of 35 U.S.C., which provides:

> "A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

> invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made."

[40] By enacting section 103, Congress added a third statutory requirement of 'nonobviousness' to the two requirements of novelty and utility that had been codified as long ago as the Patent Act of 1793. However, a similar requirement of 'invention' had been established by judicial precedent as early as 1850 in the Supreme Court's opinion in *Hotchkiss v. Greenwood,* 11 How. 248, 267 (1850), stating:

> ". . . unless more ingenuity and skill . . . were required . . . than were possessed by an ordinary mechanic acquainted with the business, there was an absence of that degree of skill and ingenuity which constitute essential elements of every invention."

In the recently decided case of *Graham v. John Deere Co.,* 383 U. S. 1 (1966), the Supreme Court held that Section 103 of the Patent Act was intended to codify the principle of the *Hotchkiss* case, "and that, while the clear language of § 103 places emphasis on an inquiry into obviousness, the general level of innovation necessary to sustain patentability remains the same." (383 U. S. at p. 4.)

It must be noted that in this case, "the time the invention was made" for purposes of section 103 must be considered as the time of the filing date of the first patent application in a foreign country, since under sec-

tions 104 and [41] 119 of 35 U.S.C.[3] a foreign inventor may not establish a date of invention earlier than his first filing date in a foreign country, assuming such date is earlier than the filing date in this country. As the Court stated in *Monaco v. Hoffman,* 189 F. Supp. 474, 481 (D.C. Dist. Col. 1960):

> "Sections 104 and 119 must be read together. They are *in pari materia.* The effect of the two provisions is to accord to a foreign inventor the benefit of the

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3. These sections provide, in pertinent part:

"§ 104. *Invention made abroad*

"In proceedings in the Patent Office and in the courts, an applicant for a patent, or a patentee, may not establish a date of invention by reference to knowledge or use thereof, or other activity with respect thereto, in a foreign country, except as provided in section 119 of this title."

"§ 119. *Benefit of earlier filing date in foreign country; right of priority*

"An application for patent for an invention filed in this country by any person who has, or whose legal representatives or assigns have, previously regularly filed an application for a patent for the same invention in a foreign country which affords similar privileges in the case of applications filed in the United States or to citizens of the United States, shall have the same effect as the same application would have if filed in this country on the date on which the application for patent for the same invention was first filed in such foreign country, if the application in this country is filed within twelve months from the earliest date on which such foreign application was filed; but no patent shall be granted on any application for patent for an invention which had been patented or described in a printed publication in any country more than one year before the date of the actual filing of the application in this country, or which had been in public use or on sale in this country more than one year prior to such filing."

filing date of his first application in a foreign country, instead of limiting him to his later filing date in the United States. On the other hand, such an inventor may not avail himself of a still earlier date of invention abroad."

[42] Although the patentees now contend that the subject matter of the patent in suit was invented in June of 1949, the "time the invention was made" must be considered as January 31, 1950, the filing date of the first application by Dr. Suess in Austria. (PX 2C.)

It must be noted also that the most pertinent prior art references for purposes of section 103 are, again, the Schwarz and Miles patents. Although the pretrial order also listed the Potts British patent as pertinent prior art, only the Schwarz and Miles patents were discussed in the opening statements, briefs after trial or final arguments as pertinent to the issue of obviousness.

The work of Drs. Durrer and Hellbruegge creates no issue as to the obviousness of the invention by the patentees, since such work does not constitute prior art under section 103. Both the statutory language and legislative history of section 103 made clear that the term "prior art" as used in section 103 refers only to "what was known before as described in section 102." S. Rep. No. 1979, 82d Cong., 2d Sess. (1952) at 6; H. R. Rep. No. 1923, 82d Cong., 2d Sess. (1952) at 7. Prior use in a foreign country is not prior art as set forth in section 102, which section refers, among other things, to inventions "known or used by others" or "in public use or on sale" in this country only, and makes no mention of inventions known, used or sold by others in a foreign country. Furthermore, defendant has admitted that

the work of Dr. Durrer and Dr. Hellbruegge is not a prior use which could invalidate the patent in [43] suit,[4] and that "use in a foreign country is of no legal effect as far as this lawsuit is concerned," (R. 4555-56). Hence, this Court is not faced with the question whether the subject matter of the patent in suit would have been obvious to persons skilled in the art familiar with the work of Dr. Durrer and Dr. Hellbruegge.

Thus the issue under section 103 in this case is whether the subject matter as a whole of the patent in suit would have been obvious to persons skilled in the art of steelmaking familiar with the Schwarz and Miles patents on or about January 31, 1950, the filing date of the Austrian application by Dr. Suess. As already noted, defendant's burden of proof on this issue of validity is a "heavy burden" requiring "more than a dubious preponderance" to satisfy. *Williams v. United Shoe Co.*, 121 F. 2d 273, 277 (CA 6, 1941). To resolve the issue of nonobviousness, the Court feels obliged to consider the differences between the subject matter as a whole of the claims of the patent in suit and the per-

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4. In defendant's main brief, p. 225, it is admitted that ". . . the work of Drs. Durrer and Hellbruegge is not, within the purview of the Patent Law of the United States, a prior use, and they are not prior patentees or prior publishers," and further states: "McLouth relies on the work of these two witnesses for the sole purpose of showing that the patentees of the patent in suit are not inventors. It is understood that when the proofs concerning Dr. Durrer and Dr. Hellbruegge are restricted to this issue, the plaintiffs do not dispute the rule that the patentees must be the true inventors." Also, in defendant's reply brief, pp. 33 and 41, it is admitted that a foreign prior use cannot be used to invalidate a United States patent.

tinent prior art, and also other objective evidence of obviousness or nonobviousness such as commercial success, for example. As the Supreme Court recently stated in the *Graham* [44] case, *supra,* 383 U. S. 1, 17-18 (1966):

> "While the ultimate question of patent validity is one of law, *A. & P. Tea Co. v. Supermarket Corp., supra,* at 155, the § 103 condition, which is but one of three conditions, each of which must be satisfied, lends itself to several basic factual inquiries. Under § 103, the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background, the obviousness or nonobviousness of the subject matter is determined. Such secondary considerations as commercial success, long felt but unsolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented. As indicia of obviousness or nonobviousness, these inquiries may have relevancy."

Further, as Judge Learned Hand stated in *Reiner v. I. Leon Co., Inc.,* 285 F. 2d 501, 503-04 (CA 2, 1960):

> "The test laid down is indeed misty enough. It directs us to surmise what was the range of ingenuity of a person 'having ordinary skill' in an 'art' with which we are totally unfamiliar; and we do not see how such a standard can be applied at all except by recourse to the earlier work in the art, and to the general history of the means available

at the time. To judge on our own that this or that new assemblage of old factors was, or was not, 'obvious' is to substitute our ignorance for the acquaintance with the subject of those who were familiar with it. There are indeed some sign posts: e.g. how long did the need exist; how many tried to find the way; how long did the surrounding and accessory arts disclose the means; how immediately was the invention recognized as an answer by those who used the new variant?"

(1) THE PRIOR ART AND THE INVENTION BY THE PATENTEES

As already discussed, the Schwarz German patent and the Miles Belgian patent taught and claimed processes of steelmaking involving blowing oxygen into a bath of molten pig iron from above. Schwarz taught blowing deeply into the bath in the manner of a solid body (DX 61, Schwarz, p. 2) and, although Miles [45] did not expressly teach "deep" penetration, it is conceded by the parties that Miles' teachings involved a deep penetration of the bath by the jet (e.g., R. 108). With regard to the blowing, the angle of the jet in the Schwarz patent is unspecific and the Miles patent recommends blowing at an angle of between 30 and 75 degrees. (DX 61, Miles, p. 17.) The Miles patent teaches that the action of the jet itself agitates and circulates the bath (DX 61, Miles, p. 18), but the Schwarz patent contains no such teaching. Both the Schwarz and Miles patents contain reference to a limited center of chemical reactions in the bath caused by contact of the jet with the bath surface. (DX 61, Schwarz, pp. 4-5; Miles, pp. 3, 15, 16.) Additionally, both the Schwarz and Miles

patents teach that the danger of excessive refractory wear is avoided in their methods of steelmaking because the chemical reactions take place at the center of the bath, away from the refractory lining. (Schwarz, pp. 4-5; Miles, p. 3.) The parties agree that the gist of the teachings of both the Schwarz and Miles patents is the necessity of penetration deep into the bath by the oxygen jet.

As already noted, according to the testimony of Dr. Durrer, the teachings of both the Schwarz and Miles patents led to no practical results in commercial steelmaking. (R. 5085.) The work of the patentees at Linz, Austria, on the other hand, has resulted in a commercially successful process of steelmaking, admittedly adopted by defendant in this case and presently used throughout the world.

If the process perfected at Linz had been obvious to steelmakers familiar with the Schwarz and Miles patents, it is [46] difficult to understand why satisfactory low phosphorus steel would not have been produced earlier than 1949. The Schwarz patent issued in 1943, and the Miles patent in 1947. At this time, there was considerable interest in developing for commercial use new methods of steelmaking involving the use of oxygen. The invention in 1928 of the so-called Linde-Fraenkl process for the production of pure oxygen made feasible the invention of new processes of steelmaking involving the use of pure oxygen. (R. 5068.) Experimentation to this end began as early as the 1930's, resulting, for example, in the Schwarz patent application in 1939. According to Dr. Durrer, numerous men experimented with oxygen refining in the 1930's

and 1940's, but their efforts did not lead to any practical results. (R. 5064-86; 5111-37.) It is disputed at what point in time pure oxygen became available in large quantities for use in commercial production of steel. Defendant contends that oxygen did not become available inexpensively in large quantities until the late 1940's, so as to inhibit the development of a commercial oxygen steelmaking process before that time. Conflicting evidence on the point leaves this Court unable to fix with certainty any date on which oxygen became available inexpensively in large quantities for commercial production of steel. However, in light of the limited experimentation with oxygen in steelmaking as early as the 1930's, the alleged unavailability of oxygen for commercial production before the late 1940's would not necessarily have been an inhibiting factor on experimentation with oxygen in steelmaking. The incentives to find a satisfactory oxygen steelmaking process were substantial, in view of the high capital and operating costs as well as the relatively slow production rates of the open hearth process. Yet there is [47] admittedly no evidence in the record that satisfactory low phosphorus steel was produced even experimentally prior to the June, 1949, tests at Linz, Austria, by the patentees. (R. 13,484-86.) Further it appears from the record that the first successful commercial operation involving an oxygen blowing process of steelmaking was installed at Linz in November, 1952. (PX 342, p. 12; PX 95, p. 783.)

The substantial advantages of the Linz oxygen blowing process of steelmaking quickly became apparent. The quality of the steel produced was com-

parable to open hearth steel, while capital and operating costs were considerably reduced. Therefore, steelmakers from all over the world came to Linz to familiarize themselves with the new Linz process. (PX 342, p. 12.) The reaction of steelmakers to the Linz process was one of initial skepticism followed by recognition of the invention and adoption of the process. Dr. Durrer stated in a memo as early as December 14, 1949, that the work at Linz "contradicts all metallurgical expectations," and "shows a new metallurgy with which we must first of all become acquainted." (DX 89B (20).) Defendant McLouth, which now contends that the process at Linz would have been obvious to steelmakers familiar with the Schwarz and Miles patents, paid $100,000 for know-how relating to the Linz process, but explains this expenditure by claiming unfamiliarity with the prior art at the time. (R. 13,818.) Such explanation is not entirely convincing, in view of McLouth's far ranging search for the most desirable method of steelmaking available, a search which involved a trip to Europe by Mr. Lindberg of McLouth. Defendant, having decided to "integrate the Austrian process into its steelmaking operations" (PX 98D; R. 1118), copied the design of the Linz operation (R. 3490-91), and proceeded to construct its OP-1 [48] shop without further experimentation of its own. (R. 3507.) However, McLouth also spent large sums to construct duplexing equipment for steelmaking in case the Linz process did not prove satisfactory. The duplexing equipment proved unnecessary, and was eventually taken out of service. (R. 3542-44, 1296-1300.) As Mr. Bryn, McLouth's President, testified (R. 1297):

"Q. In other words, even at that time you weren't sure whether by this new process you would be able to produce steel of adequate quality to meet your demands?

"A. That's right.

* * *

"Q. And I gathered from your statement that you were not sure at the time as to whether or not you would be able to get a product comparable with the product of the open hearth process?

"A. That's right. That's the reason we spent the dough to make it possible to duplex or *otherwise we wouldn't have thrown that dough out the window.*" (Emphasis added.)

The remarkable success of the Linz process is dramatically illustrated by the fact that no open hearth furnace has been built in this country since 1953, when knowledge of the Linz process became available in this country. (R. 5922-23.) As already mentioned, more than 75% of all new steelmaking facilities since 1954 or now in the planning stage are Linz process installations (PX 342, p. 13); 16 steel companies in the United States alone have either begun or planned commercial production using the basic oxygen process in use at Linz (PX 104, p. 3); and 64 companies in 23 foreign countries have installed the process. It was estimated at trial that the basic oxygen steelmaking annual capacity in this country as of January 1, 1966, would be roughly 32 million tons. (R. 5871-72.)

[49] In short, there was a striking difference in the results achieved by the process developed and practiced at Linz as compared with the results of the prior art,

and particularly the Schwarz and Miles patents. As recently stated by the Sixth Circuit Court of Appeals in the case of *Simplicity Manufacturing Co. v. Quick Mfg., Inc.*, 355 F. 2d 1012, 1015-16 (1966), the patentee's "ingenuity and resourcefulness brought about a result which the prior art inventors were unable to conceive or anticipate."

There was apparently some confusion even among the patentees themselves as to the true explanation for such difference in result. As Dr. Hauttmann said in his affidavit submitted to the Patent Office (DX 117, p. 3): "While the advantages of the new method were appreciated at once, a completely satisfactory explanation for the improved result was not readily apparent."

Dr. Suess filed patent applications in many countries, including the United States application dated January 16, 1951, claiming the gist of the invention to be the maintenance of a certain proper ratio between the bath depth and surface area. However, in his original Austrian application dated January 31, 1950 (PX 2C), and also in the first four claims of his United States continuation in part application (PX 2A), Dr. Suess claimed the avoidance of deep penetration in the bath by the oxygen as the essence of the invention. Two of the other patentees, Dr. Hauttmann and Dr. Rinesch, apparently also shared this theory, at least in 1957 when they presented affidavits to the Patent Office. The Rinesch affidavit states that the patentees determined in the June, 1949, tests at Linz "that a satisfactory refining operation could be obtained so long as the oxygen jet does not penetrate deeply into the bath." (DX 116, [50] p. 4.) The Hauttmann affidavit considered the in-

vention to be the creation of a limited center of reaction "substantially in the surface layer" resulting in a controlled circulation of the bath. (DX 117, pp. 3-4.) Dr. Hauttmann also expressed his opinion that the limited center of reaction and circulation was brought about by the avoidance of deep penetration. (DX 117, pp. 4-5.) Dr. Trenkler, the other patentee, testified that the only significant difference in practice over prior teachings was a reduction of the impact pressure of the jet and, therefore, a lesser penetration into the bath by the jet than would have resulted from prior teachings. (R. 11,905.) Thus, at one time or another, all four of the patentees expressed their understanding that the avoidance of deep penetration was the basis of a successful oxygen steelmaking process.

(2) THE MEANING OF "THE AVOIDANCE OF DEEP PENETRATION"

Clearly, the phrases "deep penetration" and "avoidance of deep penetration" have no precise meaning. Further, it is apparent that these phrases have been given different meanings by various people since the Schwarz patent first used the phrase "deep penetration" in 1943. As Mr. Justice Holmes once said: "A word is not a crystal, transparent and unchanged; it is the skin of a living thought and may vary greatly in color and content according to the circumstances and the time in which it is used." *Towne, v. Eisner,* 245 U. S. 418, 425 (1918). Thus the word "deep" has received a variety of definitions in regard to penetration of the bath depending on the motives of the person defining the word.

To Schwarz, deep penetration apparently meant penetration of the bath sufficient to avoid a mere surface reaction of [51] the jet. The Schwarz patent states:

"Surface contact is not sufficient in most cases to produce a rapid reaction, such as the blowing of the gas over the surface of the bath or the mere blowing of the gas onto the surface of the bath." (DX 61, Schwarz p. 1.) Dr. Durrer and Dr. Hellbruegge apparently had a similar underdstanding of the term "deep penetration." (See DX 61, Hellbruegge, *Stahl und Eisen* Article, pp. 5, 7.) Demonstration number six at Ann Arbor, Michigan, during the trial of this litigation, established that such a surface reaction is not satisfactory for steelmaking because of a dangerous slopping condition that results, and also the poor quality of the steel produced. For Schwarz, "deep" penetration did not mean sufficient penetration to cause refractory damage. The Schwarz patent states:

> "In the refining of steel with oxygen-enriched air or oxygen, when using the method in accordance with the invention, the danger of rapid wear of the container liner is eliminated since the reaction between oxygen and iron or iron-accompanying substances with the phenomena resulting therefrom, namely local overheating and accumulation of ferrous oxide, takes place in the center of the steel bath and therefore, the walls of the vessel are not substantially attacked." (DX 61, Schwarz, pp. 4-5.)

Miles, also, taught that the penetration of the jet should stay "at a good distance from the refractory lining of the furnace" so as to avoid refractory wear. (DX 61, Miles, p. 3.)

Dr. Suess in his many patent applications mentions the avoidance of deep penetration as desirable. The original Austrian application explains that deep penetration would result "in an undesired reaction of the

slag due to the strong swirling motion and that it would reduce the surface lining considerably." (DX 2C, p. 2.) However, when the Suess application in Germany was faced with opposition by the Schwarz patent, Dr. Suess attempted [52] to distinguish the Schwarz patent as follows:

> "In contradistinction to [Schwarz], in the case of the process of the present invention the molten bath is blown with so little kinetic energy that the oxygen does not penetrate. The movement of the bath is caused solely by chemical reactions on the surface. As soon as they are at an end, no penetration of the oxygen and no movement of the bath take place." (DX 93 B, pp. 31-32.)

Thus, Dr. Suess attempted to distinguish his German application from the Schwarz patent by defining the avoidance of deep penetration as no penetration at all. Similarly, Dr. Rinesch and Dr. Hauttmann were faced with the problem of distinguishing the prior art in prosecuting the United States Patent Application in 1957. The Rinesch affidavit states:

> ". . . our concept of avoiding deep penetration of the molten metal with the oxygen blast is just the opposite of the methods disclosed in the Schwarz and Miles et al. patents . . ." (DX 116, p. 7.)

Dr. Rinesch also said that deep penetration:

> ". . . creates an uncontrollable turbulence in the bath. The oxygen remains dissolved in the bath and the high oxygen content in the final steel leads to hot shortness or requires unsatisfactory quantities of deoxidizers. Furthermore, the phosphorous cannot be slagged off. Moreover, the walls, and par-

> ticularly the bottom of the vessel become as hot as the reaction center and, therefore, are eroded severely." (DX 116, p. 6.)

Dr. Hauttmann in his affidavit stated:

> ". . . our concept of securing purification of the entire contents of the bath mainly by the controlled circulation induced by the reaction center is just the opposite of trying to carry the oxygen to all parts of the bath by agitation produced by deep penetration . . ." (DX 117, p. 5.)

Dr. Hauttmann's affidavit also associates deep penetration of the bath by the oxygen jet "with agitation producing injury to the lining and its consequent interference with the refining [53] action . . ." (DX 117, p. 3.) Thus, both Dr. Rinesch and Dr. Hauttmann contend in their affidavits that the subject matter sought to be patented involved avoidance of the deep penetration taught by Schwarz. However, both Dr. Rinesch and Dr. Hauttmann also define deep penetration with reference to agitation or turbulence of the bath, excessive refractory wear, and poor quality of the steel produced.

The first four original claims of the continuation-in-part application of the patent in suit, which expressly claimed the avoidance of deep penetration, were rejected by the Patent Office along with all other claims submitted at the same time as unpatentable over the prior art Miles patent. In response to this rejection, counsel for the applicants wrote a letter to the Patent Office attempting to distinguish the Miles patent by contending that the applicants' method differed from the Miles method "in emphasizing a much lower impingement

pressure and a practically negligible penetration of the surface of the molten metal by the oxygen jet." (PX 2 A, p. 68.) Clearly, the patentees and their attorneys defined the avoidance of deep penetration as practically no penetration at all in order to distinguish the prior art for purposes of prosecuting their own patent applications.

The specification of the patent in suit refers to the concept of avoidance of deep penetration in four different places (Col. 3, lines 46 and 74; col. 4, line 70; and col. 9, line 18.) Most significantly in column 3, lines 64 to 75, the patent teaches that the process, when conducted under certain specified operating conditions:

> " . . . produces a sufficiently high reaction velocity of the oxygen with the bath constituents [54] to insure the development of autogenous heat at a rate sufficient to provide the heat required for completion of the refining in a minimum of time, consistent with controlled temperature and control and development of other *necessary and required process conditions, such as fluid slag, avoidance of overoxidation (undue loss of iron to the slag), and avoidance of slopping. The process conducted under these conditions avoids a deep penetration of the oxygen gas into the molten bath which seriously impairs refractory life at the bottom of the refining vessel.*" (Emphasis added.)

This important reference in the specification gives a new meaning to the phrase "avoidance of deep penetration" and at the same time discloses a crucial teaching of the patent in suit. According to this reference, the avoidance of deep penetration means a penetration suffi-

cient to avoid a surface reaction and slopping, and yet not deep enough to seriously impair refractory life at the bottom of the vessel, or to prevent the formation of the fluid slag which, according to the patent, is necessary for adequate phosphorus removal.

The claims of the patent in suit do not expressly refer to the concept of deep penetration or its avoidance. However, plaintiffs in this litigation contend that the avoidance of "material agitation of the bath by the oxygen stream" incorporates the idea of avoiding deep penetration. (E.g., plaintiffs' main brief, p. 268.) In the association of deep penetration with "material agitation" of the claims, plaintiffs now urge a broad definition of deep penetration as penetration sufficient to burn the bottom of the refractory. (E.g., plaintiffs' main brief, pp. 274-76.) However, such a definition ignores the further limitation placed on penetration by the specification of the patent in suit with regard to the formation of a fluid slag. [55] As already noted, the specification teaches that when a fluid slag is formed on the surface of the metal, deep penetration within the meaning of the patent is avoided. Thus, if a thick slag rather than a fluid slag is formed during the blowing operation, deep penetration within the meaning of the specification of the patent in suit is not avoided even though there may be no refractory damage.

There has been considerable disagreement as to the numerical degree of penetration taught by the patent in suit. Dr. Hauttmann testified that the process of the patent in suit involved a penetration of not more than one-half of the bath depth. (R. 2530.) Dr. Trenkler testified that penetration from one-third to one-half of

the bath depth would be the maximum penetration under the teachings of the patent in suit. (R. 11,911.) Dr. Elliott said that, in his opinion, "deep penetration arises when the jet enters more than, say, 35 to 40 per cent of the bath depth." (R. 6637.) Mr. Stone, on the other hand, said that he was sure only that a penetration of 90% to 100% of the bath would be deep penetration. (R. 7179.) Defendant's witness, Dr. Flinn, stated that the patent teachings would not enable him to assign any quantitative meaning to the term "deep penetration." (R. 8014-15.)

It must be noted at this point that defendant claims to be practicing deep penetration by blowing from one-third to two-thirds of the bath depth (R. 10,995; Defendant's main brief, p. 130) and, therefore, following the teachings of Schwarz. (R. 13,819.) Defendant also contends that the term "deep penetration" as used in the Suess patent means a "practically negligible penetration." (Defendant's reply brief, p. 98.) Thus, on the [56] one hand, at least one witness for plaintiffs sees the avoidance of deep penetration as any penetration less than 90% of the bath depth, while, on the other hand, defendant sees the avoidance of deep penetration as literal surface blowing without any penetration of the bath at all. (Defendant's reply brief, p. 99.)

(3) NONOBVIOUSNESS OF THE INVENTION

It appears to this Court that penetration of the bath by the jet within the limits taught by the specification of the patent in suit is the reason for the success of the Linz process. Such penetration results in a steelmaking operation that avoids the problems of refractory damage and excessive phosphorus in the finished steel

which had rendered the prior art teachings commercially inoperable. It also appears to this Court that blowing so as to achieve such a limited degree of penetration was unobvious to persons skilled in the art prior to 1950. Indeed, by 1950 there would have been good reason for persons skilled in the art to despair of finding a successful oxygen blowing process for steelmaking in light of the failures of the prior art teachings and the numerous unsuccessful experiments with oxygen blowing conducted during many years prior thereto. On the one hand, a series of patents going back as far as the Robert Patent (DX 61) in 1888 had taught literal surface blowing with only negligible penetration of the bath by a jet or jets and produced no practical results. On the other hand, the processes of the Schwarz, Miles and Potts patents, which taught deep blowing, were also commercially inoperable. Therefore, the entire approach to steelmaking by blowing oxygen from above onto a bath might well have seemed unfruitful in light of the failures of both surface blowing and [57] deep blowing. The success of the patentees appears to have been the result of using an intermediate degree of penetration between surface blowing and deep blowing.

A significant difference between the teachings of the specification of the patent in suit and the Schwarz and Miles patents is that the patent in suit places a maximum limit on penetration with reference to the formation of a fluid slag. The Schwarz and Miles patents contain no such teaching, and, therefore, a steelmaker following the teachings of Schwarz and Miles might well blow oxygen deeper into the bath than the maximum limit permitted by the teachings of the pat-

ent in suit and thereby fail to obtain the fluid slag necessary for adequate phosphorus and sulphur removal. Such maximum limit on penetration appears to this Court to be the real gist of the invention by the patentees (see testimony of Dr. Trenkler, R. 11,904-05), and seems to have been unobvious, in view of the apparent failure of steelmakers to observe such limit of penetration following the teachings of the Schwarz and Miles patents.

(4) NONOBVIOUSNESS OF THE CLAIMS

It is not clear that the actual invention of the Linz process is incorporated in the claims of the patent in suit. It is true that the Rinesch and Hauttmann affidavits in 1957 attributed a causal connection between the avoidance of deep penetration and the existence of the features of the patent claims, including a localized reaction zone, the avoidance of material agitation of the bath and a circulation caused by chemical reactions. For example, Dr. Rinesch stated (DX 116, p. 7):

> [58] "The important feature of the invention resides in controlling the force of the oxygen jet vertically impinging on the bath surface to cause a limited center of reaction to be created in the surface layer and to avoid deep penetration into the bath, whereby an automatic circulatory movement is obtained in the converter vessel, and the entire charge is refined by the oxygen molten metal reactions in the limited center and the slag-metal reactions in the bath surrounding the reaction center."

However, it is a serious question whether persons skilled in the art of steelmaking in 1950 would have un-

derstood the features of the claims of the patent in suit as depending upon the avoidance of deep penetration for their existence. In other words, it is questionable whether the claims of the patent in suit have any clear connection with what appears to this Court to be the actual invention by the patentees. Such issue, however, arises under Section 112 rather than Section 103 and will be discussed below. As already noted, the *Graham* case, *supra,* 383 U. S. 1, at p. 17, makes clear that the issue under Section 103 requires an analysis of the differences between the prior art and the *claims* at issue, since only the subject matter of the claims constitutes "subject matter sought to be patented" within the meaning of Section 103. The issue under Section 103 is the obviousness of the subject matter of the claims to persons skilled in the art and not the obviousness of unclaimed subject matter disclosed by the specification, which constitutes a dedication to the public. *Edward Miller & Co. v. Bridgeport Brass Co.,* 104 U. S. 350, 352 (1881).

First of all, it is doubtful whether the claim of vertical blowing would have been obvious to steelmakers in 1950 in view of the unspecific teaching of Schwarz on the point and the recommendation of Miles to blow at an angle of between 30 and 75 [5½] degrees.

The claim of blowing "onto and below the surface of the bath at the central portion thereof, to an extent to avoid material agitation of the bath by the oxygen stream" is almost certainly nonobvious in view of Miles' teaching that when the oxygen jet was blown below the surface, the jet agitated the bath. Further, it is defendant's position that agitation of the bath in McLouth's

steelmaking operation is largely the result of the mechanical action of the oxygen jet. Plaintiffs contend that material agitation of the bath is agitation sufficient to overcome the alleged down in center circulation of the bath created by chemical reactions. (E.g., main brief, p. 191.) Such a concept would certainly not have been obvious to steelmakers in 1950, since at that time the very idea of a down in center circulation caused by chemical reactions was not generally known to persons skilled in the art. Indeed, the concept of a down in center circulation of the bath caused by chemical reactions is not a well recognized and accepted phenomenon, even today. There is disagreement in the expert testimony in this litigation as to its existence; it is not clearly taught by the specification of the patent in suit; and other patents, notably the Cuscoleca and Walker patents, advance alternative theories of circulation relating to chemical reactions. (DX 68.) But if a down in center circulation caused by chemical reaction is itself not necessarily obvious to steelmakers even today, it is difficult to understand how the idea of avoiding a material agitation of the bath by a jet which would overcome such a circulation would be obvious.

The language in the claims of the patent in suit concerning the avoidance of material agitation was an apparent [60] effort by the applicants to distinguish the prior art Miles patent, which taught that a jet agitates the bath. At the time this feature of the patent claims was first presented in June of 1957, previous claims had been rejected as unpatentable over Miles. There was, therefore, the necessity for presenting new claims which in some manner would distinguish the Miles patent in

order to obtain a patent grant. It is significant also to note that the patent itself issued less than two months after the final claims including language referring to the avoidance of material agitation were submitted to the Patent Office. Previous to June, 1957, no reference had been made to the concept of avoidance of material agitation by the oxygen stream anywhere in the file wrapper history of the patent insuit. Incidentally, the concept is not mentioned in any of the foreign patents on the Linz process granted to Dr. Suess. (DX 83.)

The "localized reaction zone spaced a substantial distance from the refractory lining" and the "high temperature" in such reaction zone are features of the claims which this Court considers anticipated by the Schwarz and Miles patents and therefore certainly obvious to persons skilled in the art. The Schwarz patent states:

> ". . . the reaction between oxygen and iron or iron-accompanying substances with the phenomena resulting therefrom, namely local overheating and the accumulation of ferrous oxide, takes place in the center of the steel bath and therefore the walls of the vessel are not substantially attacked." (DX 61, Schwarz, pp. 4-5.)

Miles' teaching that "the source of chemical oxidation reaction is located within the bath at a good distance from the refractory lining" implies a localized reaction zone, and, further, Miles' teaching of blowing oxidizable elements in with the jet to [61] "increase the temperature locally where the jet strikes the bath so as to bring about the oxidizing action more rapidly" suggests a localized reaction zone with higher temperatures than the rest of the bath. (DX 61, Miles, pp. 3 and 15.)

The nonobviousness of the claim of a circulatory movement in the molten metal produced by chemical reactions has already been discussed in connection with the claim of avoidance of material agitation. It seems clear to this Court that such a reaction-induced circulation would not have been obvious to steelmakers in 1950, especially in view of the teaching of the Miles patent that the action of the jet agitates and circulates the bath, and also in view of the disagreement among the expert witnesses at the trial, even in 1964, whether such a reaction-induced circulation in fact exists.

Defendant in effect concedes the nonobviousness of the subject matter of the claims of the patent in suit by repeatedly contending in its opening statement, its briefs after trial and its final arguments that the process of the claims does not exist, or, in other words, that there is no such thing in steelmaking as a reaction-induced circulation or the avoidance of material agitation of the bath by the oxygen stream.

On opening statement, counsel for defendant stated:

> "They [Schwarz and Miles] weren't compelled to resort to the subterfuges of the patent in suit. They didn't have any absurdities about the avoidance of material agitation. So there are differences between the patent in suit and Schwarz and Miles.
>
> "But to the extent that the patent in suit departs from Schwarz and Miles it is pure phoney, nonpracticed, non-known, in any commercial operation in the world." (R. 143-44.)

[62] Defendant's main brief after trial states:

"The patent, in teaching a down-in-the-center circulation, taught something which does not exist. And the claims of the patent, in calling for a reaction-induced circulation, call for something else which does not exist." (P. 189; see also 177, 210-11.)

Similarly, defendant's reply brief states:

"The reaction-induced circulation comes into this case only through the claims of the patent in suit, and, in fact, does *not* exist." (P. 40. Emphasis is in original.)

Further, defendant's proposed finding of fact No. 83 requests the Court to find that "the claims in requiring that circulation be produced by chemical reaction, call for something which does not exist."

On final argument, the following colloquy occurred:

"*The Court*: Of course, if the process is as the patent claims to be, then it would be a patentable invention; there wouldn't be any question about that, would there?

"[*Counsel for Defendant*]: Well, if they had a circulation which was induced by chemical reaction, and if they had a circulation down in the center, they would have something that no one has ever heard of before; and so conceivably that would be an invention. Its application to the making of steel is something else again. I don't know whether it would work or not. But it's something that no one has ever faced, because they can't do it.

"*The Court*: Well, I mean, if the claims were supported and taught by the specifications, it would be a patentable invention, would it not?

"[*Counsel for Defendant*]: If the claims were supported in the sense that there was such a circulation, it would certainly be entirely new. It is something of which the world has never heard, and something which, except for the testimony in this case, there is no support anywhere in any scientific annal of which anybody in this case has ever heard. Plaintiffs have been challenged to bring forward some substantiation, and they haven't come forward with an iota." (R. 13,511-12; see also R 13,711.)

[63] Assuming defendant is correct in contending that the process as claimed in the patent in suit does not exist in actual steelmaking operations, it follows that the process as claimed could not have been obvious to persons skilled in the art.

(5) CONCLUSION

In short, this Court concludes that defendant has not sustained its burden of proving that the subject matter of the claims of the patent in suit would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. In reaching such conclusion, the Court draws a clear distinction between the subject matter of the claims and the subject matter of the specification, also found unobvious. The specification discloses the gist of the invention of the patentees, to avoid blowing deeply so as to assure the formation of an early fluid slag. The long-standing need for such an in-

vention; the many unsuccessful attempts to solve the problem in the years prior to 1949; the significant advantages of the invention; and the enthusiastic reaction of the industry to the invention after a period of initial skepticism, all clearly indicate that the invention by the patentees, the Linz process, was not obvious to persons skilled in the art.

It should be noted that the defendant's position on the issue of obviousness has been equivocal throughout this litigation. Although the pretrial order states an issue in the language of Section 103, the opening statements and briefs of defendant after trial never expressly referred to Section 103. Instead, defendant contended vaguely that the patent in suit was invalid for lack of invention over the Schwarz and Miles patents, a confusing contention which could invoke defenses under either Section [64] 102 or Section 103. On closing arguments, defendant did expressly rely on Section 103 (R. 13,410), but practically conceded nonobviousness of the subject matter of the claims of the patent in suit, as already noted. (R. 13,511-12.)

C. Inventorship

Defendant in this case has also raised an issue that the patentees of the patent in suit did not themselves invent the subject matter sought to be patented, but rather that the invention was entirely disclosed to the patentees by Dr. Durrer and Dr. Hellbruegge. Such a defense arises under 35 U.S.C. §102(f), which provides that a person shall not be entitled to a patent if "he did not himself invent the subject matter sought to be patented." As previously noted, Section 103 clarifies Sec-

tion 102 by adding a further requirement of nonobviousness for patentability, even if the invention is not "identically disclosed or described" to the patentee by someone else. Thus Section 103 makes clear that the test as to whether the patentees themselves invented the subject matter is whether it was "identically disclosed or described" to them by Dr. Durrer and Dr. Hellbruegge.

Section 282 of 35 U.S.C. places the burden of proof as to this issue on the defendant, as in all issues concerning the validity of the patent in suit. Defendant's burden of proving that the patentees were not the true inventors is heavy and requires evidence which is convincing perhaps even beyond a reasonable doubt. *Becton-Dickinson & Co. v. Robert P. Scherer Corp., et al.*, 106 F. Supp. 665 (E.D. Mich. 1952), affirmed 211 F. 2d 835; *Manton-Gaulin Mfg. Co. v. Dairy Machinery & Construction Co.*, [65] *Inc.*, 238 F. 210 (D. Conn. 1916), affirmed 247 F. 317; *Protector Last Reinforcing Co. v. John Pell & Son, Inc.*, 204 F. 453 (D. N.J. 1913). As Judge Tuttle of this District stated in *Fruehauf Trailer Co. v. Highway Trailer Co.*, 54 F. 2d 691, 702 (E.D. Mich. 1931), affirmed 67 F. 2d 558 (CCA 6, 1933):

> "To take up first the testimony of Learman relating to the first Borst patent coupling device particularly, tending to show that Borst stole his notions, I will say that we are now in a branch of the law, patent law, which is very clear and well settled. Any claim of that kind tending to destroy the originality of the patentee, before it can be entertained by the court, must be shown by very convincing and strong evidence. It is well recognized that the memory of man is not sufficient to meet

that test. There must be something more tangible. We look for records that fix dates, a very definite sort of thing to tie to . . ."

Incidentally, defendant does not appear to dispute the severity of its burden of proof on this issue. Thus, the issue with respect to inventorship is whether defendant has proved by evidence that is convincing beyond a reasonable doubt that the patentees did not themselves invent the subject matter of the patent in suit because the subject matter was identically disclosed to them by Dr. Durrer and Dr. Hellbruegge. To resolve this issue, the Court is obliged to consider evidence concerning the teachings and disclosures of Dr. Durrer and Dr. Hellbruegge to the patentees, the results achieved in steelmaking by Dr. Durrer, Dr. Hellbruegge and the patentees, and also relevant acts and statements by Dr. Durrer and Dr. Hellbruegge concerning oxygen steelmaking.

(1) THE TEACHINGS OF DR. DURRER AND DR. HELLBRUEGGE AND THE PATENTEES

Dr. Durrer and Dr. Hellbruegge were distinguished scientists and steelmakers particularly concerned with the use of [66] oxygen in steelmaking. Dr. Durrer had been an advocate of the use of pure oxygen in steelmaking as early as the 1930's, and both Dr. Durrer and Dr. Hellbruegge had had considerable independent experience in steelmaking by 1948. In the spring of that year, they commenced experiments at the Von Roll Steel Works in Gerlafingen, Switzerland, involving the use of oxygen blown from above into a molten pig iron bath. Such experiments continued at least intermittently

throughout 1948 and the spring of 1949. During that time, Dr. Durrer and Dr. Hellbruegge were in limited contact with Dr. Trenkler and Dr. Suess, two of the patentees, concerning the experiments at Gerlafingen. Dr. Hellbruegge in particular was enthusiastic about the results achieved, and notified Dr. Trenkler in April of 1949 that "We are now working for production." (DX 21 B, p. 1; see also pp. 11,817-18.) The process employed by Dr. Durrer and Dr. Hellbruegge at Gerlafingen was described in an article written by Dr. Hellbruegge appearing in 1950 in the magazine *Stahl und Eisen* (DX 61) and also by the testimony at trial of Dr. Durrer and Dr. Hellbruegge, as well as the patentees. It is admitted by defendant that the practice of Dr. Durrer and Dr. Hellbruegge at Gerlafingen was essentially indistinguishable from the teachings of the Schwarz patent. (E.g. R. 13,503.) In general, the practice at Gerlafingen consisted of blowing pure oxygen in a single jet initially at an angle, but in later tests, vertically down into the pig iron bath so as to achieve a deep penetration of the bath by the jet. Thus Dr. Hellbruegge states in his article (p. 5):

> "The blowing onto the bath must not be done with too little pressure, as otherwise there will be only a surface reaction. This means that too much oxygen is lost. The refining takes too long a time and the iron content of the slag will be too high."

[67] Dr. Hellbruegge further states (p. 7):

> "The pressure of the oxygen jet must be sufficiently strong to cause the jet to penetrate into the bath, especially at the beginning and toward the end of the melt."

Dr. Hellbruegge testified this was still his thinking at the time of trial (R. 4909-11; 4670). Further, in a letter written in 1952, he stated:

> "The oxygen process, as introduced at the time in Linz by Gerlafingen within the Study Group, does not in my opinion circumvent the Schwarz patent, since there is not simply top blowing, but the jet must penetrate deep, even though it need not be supersonic speed." (DX 89B (25), p. 4.)

At trial, Dr. Hellbruegge affirmed this statement as his thinking at the time. (R. 4667.)

Dr. Durrer testified at the trial that the Schwarz patent contained his ideas. (R. 5101.) Further, in the memorandum prepared by Dr. Hellbruegge of a meeting in Solothurn, Switzerland, held on June 9, 1949, it is stated:

> "In the case of Prof. Schwarz's patent applications there is in all probability concerned in accordance with Dr. Durrer's statement, the theft of intellectual property." (PX 301B, p. 4.)

This memorandum further indicates Dr. Durrer's opinion that the Schwarz patent resulted from discussions that Dr. Durrer himself had had with the Brassert Company in the 1930's. In any event, Dr. Durrer affirmed the similarity of his teachings to those of the Schwarz patent, regardless whether Dr. Durrer himself was the true inventor of the process claimed in the Schwarz patent. (R. 5100-01.)

Dr. Trenkler testified that Dr. Durrer and Dr. Hellbruegge taught deep penetration of the bath by the jet. (R. 11,950.) Dr. Hauttmann testified that the Durrer method corresponded [68] to that of Schwarz. (R. 2555-

56.) Defendant has admitted in its opening statement, final arguments and briefs after trial that Dr. Durrer and Dr. Hellbruegge taught deep blowing.[5]

Also, with regard to penetration, Dr. Trenkler testified that Dr. Durrer and Dr. Hellbruegge taught going as close to the bath as possible with the nozzle. (R. 11,805, 11,870, 11,873, 11,894 11,931, 11,941.) The effect of such teaching would be, of course, to increase the depth of penetration of the bath by the oxygen jet.

In contrast to the teachings of Dr. Durrer and Dr. Hellbruegge as to the necessity of a deep penetration of the bath by the oxygen jet, the patentees taught the avoidance of deep penetration as the gist of their invention. The patent itself expressly teaches the avoidance of deep penetration at column 3, lines 46 and 74; col. 4, line 70; and col. 9, line 18. Also, the Rinesch affidavit (DX 116) states that "A satisfactory refining operation could be obtained as long as the oxygen jet does not penetrate deeply into the bath." The Hauttmann affidavit (DX 117) makes essentially the same statement. And Dr. Trenkler testified as to the importance of the avoidance of deep penetration in the process of the patent in suit. (R. 11,942 and 11,904.) Further, Dr. Suess was also apparently aware of the importance of avoiding deep penetration, as indicated by the claims of his original Austrian application (PX 2C) and the first four claims of the United States continuation-in-part

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5. See, for example, main brief p. 227 stating that the process of the patent is the process taught by Dr. Durrer, and also p. 152 ff. stating that the avoidance of deep penetration is a fiction in the patent suit. See also reply brief p. 42 stating that the teachings of Schwarz and Durrer are the same and both entailed deep blowing.

application. (PX 2A.) Thus [69] the teachings of Dr. Durrer and Dr. Hellbruegge that a deep penetration of the bath by the jet is essential are in contrast to the teachings of all four of the patentees that deep penetration must be avoided.

A further significant teaching of Dr. Durrer and Dr. Hellbruegge concerns the iron content of the slag. Apparently Dr. Durrer and Dr. Hellbruegge were concerned in their steelmaking experiments in keeping the iron content of the slag as low as possible. In the *Stahl und Eisen* article (DX 61, p. 13), Dr. Hellbruegge stated that when oxygen was blown with too small a pressure, the iron loss to the slag was too high. He also stated at p. 9 that in the satisfactory heats at Gerlafingen, the iron content of the slag varied between 9% and 11%. At trial, Dr. Hellbruegge testified that he wanted to keep the iron content of the slag as low as possible, but "unfortunately" he could not get it any lower than 9% in the Gerlafingen tests. (R. 4926.)

Dr. Trenkler testified that according to the teachings of Dr. Durrer and Dr. Hellbruegge, "the oxygen jet has to penetrate into the lower regions of the bath so that a corresponding bath movement by the oxygen stream will be insured and a low iron content of the slag can be obtained." (R. 11,894.)

In contrast, the patentees were not primarily concerned with keeping a low iron content in the slag during their steelmaking experiments. The Rinesch affidavit (DX 116, p. 4) notes that in the satisfactory June 25 series of tests at Linz "the iron content of the slag increased to an average of 14 to 20%." The patent itself teaches at col. 5, line 60, to col. 6, line 51, that a

certain amount of oxidized iron in the slag is essential for the formation of the early fluid slag which results in an [70] accelerated rate of phosphorous removal from the bath. At col. 6, line 44, the patent approves an iron content of from 9% to 18% in the slag "with generally higher FeO content in the slag at higher phosphorus contents in the pig iron." In other words, according to the teachings of the patent in suit, a higher iron content in the slag than that approved by Dr. Hellbruegge is deemed essential for adequate phosphorus removal from the bath. Apparently Dr. Durrer and Dr. Hellbruegge, unlike the patentees, were more concerned with keeping down the iron content of the slag than with lowering the phosphorus content of the bath to desirable levels for high quality steel.

(2) THE DISCLOSURES OF DR. DURRER AND DR. HELLBRUEGGE TO THE PATENTEES

On May 12, 1949, Dr. Trenkler, one of the patentees, made a visit to Gerlafingen, Switzerland, to acquaint himself with the work which Dr. Durrer and Dr. Hellbruegge had been carrying on. While at Gerlafingen, Dr. Trenkler had "thorough discussions" (R. 11,805) with Dr. Durrer and Dr. Hellbruegge concerning their work and received detailed information about the Gerlafingen operation which he later incorporated into a memo (DX 11B) dated May 15, 1949. This memo establishes the disclosure to Dr. Trenkler of:

1. The use of pure oxygen.
2. The use of a blowing method of steelmaking without additional heating of the bath.
3. Use of a 2-ton Bessemer converter.

4. Vertical blowing.

5. The use of an 8 mm. nozzle.

6. Seven atmospheres of blowing pressure.

[71]7. A scrap accumulation of 50% when Thomas pig iron is used and a 30% scrap accumulation with steel-pig.

8. The cost of oxygen as corresponding with air costs of a standard operation.

9. The quality of the steel produced as being "substantially more favorable in regard to impact tenacity and aging-impact tenacity than the Belgian Thomas iron with which it was compared."

With regard to nozzle bath distance, Dr. Trenkler testified at the trial that he was not given any numerical distance (R. 11,806-08, 11,931) despite his "thorough" discussions with Dr. Durrer and Dr. Hellbruegge. Dr. Trenkler testified that he was told only to go as close to the bath as possible with the nozzle (R. 11,805, 11,870, 11,873, 11,931, 11,941). On the other hand, Dr. Durrer and Dr. Hellbruegge testified at the trial that they mentioned to Dr. Trenkler a nozzle bath distance of 20 centimeters (roughly 8 inches). (R. 4593, 4621, 4652, 4928, 5022.) There appears from the record good reason to accept the testimony of Dr. Trenkler on this point over that of Dr. Durrer and Dr. Hellbruegge. In the only contemporary statement on the point, the Trenkler memo DX 11 B dated May 15, 1949, there was no mention of any nozzle bath distance disclosed by Dr. Durrer and Dr. Hellbruegge, even though there was no reason to omit such information from the memo at that

time if it had been given. Further, the evidence shows that the men at Linz wanted to follow the teachings of Dr. Durrer and Dr. Hellbruegge as well as Schwarz and Miles in the tests beginning June 17, 1949. (Dr. Hauttmann, R. 2659-60.) Dr. Trenkler noted in his memo DX 11B: "It is absolutely essential that we examine the relationships in blowing our steel-pig with oxygen by thorough testing." Yet Dr. Trenkler used a nozzle bath [72] distance of ten centimeters (roughly 4 inches) in the June 17th tests following the teachings of Dr. Durrer and Dr. Hellbruegge and thus went even closer to the bath with the nozzle than Dr. Durrer had done at Gerlafingen. It seems unlikely that Dr. Trenkler would have departed from the teachings of Dr. Durrer and Dr. Hellbruegge in this one particular in a series of tests which were intended to follow the teachings of Dr. Durrer and Dr. Hellbruegge. Significantly, in the June 17th series of tests, Dr. Trenkler got even poorer results with regard to phosphorus removal and refractory damage than Dr. Durrer and Dr. Hellbruegge had gotten at Gerlafingen, apparently because Dr. Trenkler placed the nozzle 10 centimeters closer to the bath. (See *infra* II C(3).) Thus, this Court finds as a fact that Dr. Trenkler was given no numerical nozzle bath distance by Dr. Durrer and Dr. Hellbruegge.

With respect to the type of nozzle to be used, Dr. Trenkler testified that he was told to use a water-cooled copper Laval nozzle. (R. 11,835.) There is no evidence in the record to the contrary.

It can, therefore, be seen that Dr. Durrer and Dr. Hellbruegge disclosed to the patentees details of a steel-making operation very similar to the operation in which

satisfactory low phosphorus steel was produced for the first time in the Linz tests on June 25, 1949. Indeed, Dr. Trenkler testified (R. 11,905) that the avoidance of deep blowing in the process at Linz was the only difference from the process of deep blowing at Gerlafingen. In like manner, Dr. Hauttmann testifed that the only changes in operating procedure made by the patentees from the June 17th tests following Dr. Durrer's teachings to the June 25th tests following the patentees' own ideas, were the change from a Laval [73] nozzle to a normal cylindrical nozzle and an increase in the nozzle bath distance from 10 centimeters to 15 centimeters. (R. 2665, 2246, 2256.) Plaintiffs also admitted on final arguments that the only mechanical changes in method from the teachings and disclosures of Dr. Durrer and Dr. Hellbruegge were the change from a Laval to a normal nozzle and an increase in the nozzle bath distance. (R. 13,184-87.)

Plaintiffs contend that Dr. Durrer and Dr. Hellbruegge did *not* disclose the concept of a reduced impact pressure of the jet on the bath so as to avoid deep penetration. Such avoidance of deep penetration, according to the plaintiffs, is "the new concept, the new mental approach" of the patentees. (R. 13,184-87.) It is not disputed that the change in nozzle type and nozzle bath distance by the patentees would have had the effect of reducing impact pressure and therefore reducing the depth of penetration. Whether such a reduction in penetration by the patentees should be considered significant for patent purposes could only be determined by a comparison of the actual results achieved by the tests at Gerlafingen and Linz. If there were no significant

differences in the quality of steel produced, the difference in the degree of penetration of the bath by the jet would have no significance, and this Court would be forced to conclude that the process at Linz was in fact disclosed in its entirety by Dr. Durrer and Dr. Hellbruegge so as to establish a defense of non-inventorship by the patentees in this case. However, analyses of the steel produced in a number of experiments at Gerlafingen and at Linz, as listed in the *Stahl und Eisen* article by Dr. Hellbruegge (DX 61, p. 11) and a work sheet (DX 116A) attached to the Rinesch affidavit (DX 116), indicate clearly that the results of the Linz tests [74] beginning June 25th were superior to those at Gerlafingen.

(3) Comparison of the Tests At Gerlafingen, Switzerland, and Linz, Austria

In the Gerlafingen tests of record, the steel produced had a relatively high phosphorus content with only 2 of 20 heats having a phosphorus content of less than .03%. The Linz June 17th tests, following Dr. Durrer's teachings but blowing even closer to the bath than Dr. Durrer had done at Gerlafingen, had an even higher phosphorous content in the steel produced, with none of the 6 heats containing less than .07% phosphorus. On the other hand, the June 25th tests at Linz obtained satisfactory phosphorus removal, with 6 of 11 heats containing below .03% phosphorus.

The Court has prepared a series of charts based on information taken from DX 61 and DX 116A concerning phosphorus content in the steel produced in the experi-

ments at Gerlafingen and Linz.[6] [75] Specifically, Chart 4, prepared by the Court, is a comparison by percentages of the heats run at Gerlafingen and at Linz with regard to the phosphorus content of the steel produced. It is

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6. Chart 1 shows what percentage of the 20 heats at Gerlafingen reported in Dr. Hellbruegge's *Stahl und Eisen* article were below certain levels of phosphorus in the final steel produced:

CHART I	*Gerlafingen tests*
20 of 20 heats below	.1 % P— 100%
18 of 20 " "	.09 % P— 90%
17 of 20 " "	.08 % P— 85%
12 of 20 " "	.07 % P— 60%
10 of 20 " "	.06 % P— 50%
7 of 20 " "	.05 % P— 35%
3 of 20 " "	.04 % P— 15%
2 of 20 " "	.03 % P— 10%
None of 20 " "	.02 % P— 0%

Chart 2 gives the same information with respect to the 6 heats of the June 17th series of tests at Linz attempting to follow the teachings of Dr. Durrer. The chart is based on two different measurements of phosphorus content in the bath, the first being an analysis of the phosphorus content of the final steel in the converter, and the second being an analysis of the phosphorus content of the steel during the pouring from the ladle into the ingot:

CHART 2 — June 17th tests at Linz

In converter	*During pouring*
2 of 6 heats below .1 — 33%	3 below .1 — 50%
1 of 6 heats below .09 — 17%	2 below .09 — 33%
1 of 6 heats below .08 — 17%	1 below .08 — 17%
None of 6 heats " .07 — 0%	None below .07 — 0%

Chart 3 gives the same information with respect to the heats reported in DX 116A from the June 25th series of tests at Linz, departing from the teachings of Dr.

important to emphasize once again at this point the desirability of a low phorphorus content, i.e., no more than .03% for satisfactory high quality steel. Higher concentrations of phosphorus tend to harden and brittle the

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Durrer by reducing impact pressure and consequently reducing penetration. An analysis of the phosphorus content of the final steel in the converter was reported in 10 heats of the June 25th series of tests. However, the phosphorus content of the steel poured from the ladle into the ingot is reported in 11 heats of this June 25th series of tests at Linz:

CHART 3 — June 25th tests at Linz

In converter	*During pouring*
10 of 10 heats below .07 — 100%	10 of 11 heats below .07 — 91%
8 of 10 heats below .06 — 80%	10 of 11 heats below .06 — 91%
6 of 10 heats below .05 — 60%	10 of 11 heats below .05 — 91%
5 of 10 heats below .04 — 50%	8 of 11 heats below .04 — 73%
4 of 10 heats below .03 — 40%	6 of 11 heats below .03 — 55%
None of 10 heats " .02 — 0%	1 of 11 heats below .02 — 9%

Significantly, in the June 25th series of tests, heats having the greatest nozzle bath distance, and, therefore, the lowest impact pressure, generally had the lowest phosphorus content in the steel produced.

CHART 4

% of Heats Containing Below	*Gerlafingen*	*Durrer Method (Linz June 17th)*		*Patentees' Method (Linz June 25th)*	
		Converter	*Pouring*	*Converter*	*Pouring*
.1 P	100%	33%	50%	100%	100%
.09 P	90%	17%	33%	100%	100%
.08 P	85%	17%	17%	100%	100%
.07 P	60%	0%	0%	100%	91%
.06 P	50%	0%	0%	80%	91%
.05 P	35%	0%	0%	60%	91%
.04 P	15%	0%	0%	50%	73%
.03 P	10%	0%	0%	40%	55%
.02 P	0%	0%	0%	0%	9%

steel and therefore limit its usefulness for many purposes. (Dr. Chipman, R. 235.) Dr. Trenkler also testified that "high phosphorus content excludes the use of the steel for all, almost all, qualities of thin sheets and deep drawing quality sheets." (R. 11,929.) Chart 4 illustrates that [76] the June 25th series of tests at Linz had significantly lower phosphorus content in the steel produced than either the previous tests at Gerlafingen or the June 17th series of tests at Linz. The striking disparities in the results of these three series of tests appears to this Court to be attributable solely to differences of impact pressures caused by the variation in the type of nozzle used or nozzle bath distance, or both.

Further, the available information with respect to the iron content of the slag in the tests at Gerlafingen and at Linz indicates an inverse correlation between the iron content of the slag and the phosphorus content of the steel produced. In the Gerlafingen tests, according to Dr. Hellbruegge, the iron content of the slag varied between 9% and 11%. (DX 61, *Stahl und Eisen* article, p. 9; R. 4926.) In the Linz June 17th series of tests involving even deeper penetration than achieved at Gerlafingen, the iron content of the slag varied from 6.7% to 9.8% [77] (DX 116A.) On the other hand, in the June 25th tests, the iron content of the slag varied from 9.6% to 33.9% with 9 of 11 heats reported being roughly in the range of 11% to 20%. (DX 116A.)

Chart 5, also prepared by the Court, illustrates an inverse correlation between the iron content of the slag and the phosphorus content of the steel in the tests at Gerlafingen and at Linz, or, in other words, illustrating that the higher the iron content of the slag becomes, at

least within the limit of the tests reported, the lower the phosphorus content of the steel tends to be.[7]

The Rinesch affidavit explains this correlation by pointing out that a slag with high iron content "forms with limestone a very fluid, lime-ferrite slag which absorbs the phorphorous as shown by the fact that it contains an average of 1.2 to 1.8% P_2O_5, as compared with 0.18% to 0.3% P_2O_5 in the slag which was formed by the deeply penetrating oxygen stream." (DX 116, p. 4.) The Rinesch affidavit also states that with deep penetration "the slag was unable to absorb FeO which, in its turn, is needed for [78] good dephosphorization." (P. 3.) Dr. Trenkler testified that "when you blow deeply the formation of the basic slag that you need for the phosphorus removal occurs too late." (R. 11,942; see also Dr. Chipman, R. 442-44.) The patent itself also teaches the necessity of an early fluid slag rich in oxides such as FeO for adequate phosphorus removal. (Col. 5, line 60, to col. 6, line 51.) Additionally, Dr. Chipman testified in detail (R. 583-87 and 606) concerning the chemistry of phosphorus removal in the Linz process. Briefly, he testi-

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7. *CHART 5*

Tests	*Iron in Slag*	*Phosphorus in Steel*	
Gerlafingen	9 —11%	— 35% of heats below	.05% P
		— 10% of " "	.03% P
Linz, June 17	6.7— 9.8%	— 0% of heats below	.05% P
Linz, June 25	9.6—33.9%	— 60% of heats in converter below	.05% P
(mainly	11 —20%)	40% of heats in converter below	.03% P
		91% of heats during pouring below	.05% P
		55% of heats during pouring below	.03% P

fied that phosphorus is removed from the bath into the slag by slag-metal reactions written as follows in PX 151:

$$2\,P\ (\text{in bath}) + 5\,FeO\ (\text{in slag}) + 3\,CaO\ (\text{in slag}) = 3\,CaO{\cdot}P_2O_5 + 5\,Fe$$

$$2\,P\ (\text{in bath}) + 5\,O\ (\text{in bath}) + 3\,CaO\ (\text{in slag}) = 3\,CaO{\cdot}P_2O_5$$

Dr. Chipman illustrated (PX 152 and 153) the effect of penetration on slag formation. The diagram in PX 152 indicated that the avoidance of deep penetration results in the formation of a slag with high FeO content. PX 153 illustrated, on the other hand, that deeper penetration puts oxygen into the metal rather than the slag, which, therefore, has a low FeO content.

Another significant difference in the tests at Gerlafingen and at Linz is the use of an afterblow in the Gerlafingen tests to remove phosphorus. Dr. Hellbruegge testified that in the Gerlafingen tests, he had to have an afterblow to get rid of phosphorus. (R. 4915; see also R. 4929-30; DX 61, *Stahl und Eisen* article, pages 9 and 13.)

The patentees, on the other hand, apparently did not use an afterblow in the Linz tests; at least there is no evidence in this record that an afterblow was ever used at Linz. [79] However, the patent in col. 6, lines 16 to 25, indicates that no afterblow is required to remove phosphorus to the desired level since, according to the process disclosed by the patent in suit, "final phosphorus contents not higher than about 0.025% and as low as 0.010% are obtained by the time the carbon end point is reached with only a single slagging operation." Fur-

ther, Dr. Trenkler testified that "you have an afterblowing time only if you blow deeply." (R. 11,948.)

The absence of an afterblow at Linz is quite significant since even without an afterblow to remove phosphorus as at Gerlafingen, the phosphorus content of the steel produced in the June 25th series of tests at Linz was still lower than in the steel produced at Gerlafingen. This difference in result is apparently explained by a different order of chemical reaction when deep penetration was avoided. Thus, in the Linz tests, phosphorus was apparently removed from the bath at the same time as carbon and not afterwards, as at Gerlafingen. As Dr. Trenkler testified: "Owing to this type of blowing to the upper regions of the bath, we have an essentially earlier dissolution of the lime, a higher Fe content in the slag, and thereby a faster and better dephosphorization." (R. 11,904.) As already noted, the patent in suit teaches this phenomenon at col. 6, lines 16 to 25. The earlier removal of phosphorus in the Linz June 25th series of tests to even lower levels than in the Gerlafingen tests, and without the need for an afterblow, indicates strongly an entirely different steelmaking process taking place in the Linz June 25th series of tests than at Gerlafingen, despite a seemingly minor change in the operating procedures.

[80] There is a further significant contrast between the tests at Gerlafingen and the June 25th series of tests at Linz concerning refractory damage. There is a dispute in the evidence as to whether at Gerlafingen problems of refractory damage had been solved. Dr. Hellbruegge in his *Stahl und Eisen* article (DX 61, p. 14) stated that in the Gerlafingen operations: "There are no difficulties

with respect to the durability of the nozzle nor to that of the converter." On the other hand, Dr. Trenkler testified that he was told at Gerlafingen that Dr. Durrer and Dr. Hellbruegge had initially encountered difficulties concerning an insufficient life of the nozzle and an extremely short life of the refractory lining lasting only one to two heats. According to Dr. Trenkler: "The transition to the bent lance blowing vertically from above remedied the difficulties consisting in the burning of the nozzle— . . . and the difficulties concerning the refractory lining became smaller without ceasing altogether." (R. 11,838-39.) Dr. Trenkler also testified that "The insufficient life of the refractory lining of the converter" (R. 11,929) was a defect in the Gerlafingen operation. The Rinesch affidavit states that in the June 17, 1949, series of tests at Linz attempting to follow the teachings of Dr. Durrer and Dr. Hellbruegge, "The lining of the converter was eroded quickly so that cansiderable quantities of MgO were released from the lining." (DX 116, p. 3.) Further, the work sheet for the Linz tests (DX 116A) notes that in the June 17th series of tests, the converter lining was strongly eroded. The Hauttmann affidavit (DX 117) and the testimony of Dr. Trenkler (R. 11,901-04) also confirmed the existence of refractory damage in the June 17th series of tests. The refractory damage experienced in the June 17th series of [81] tests at Linz following the teachings of Dr. Durrer and Dr. Hellbruegge gives some reason to accept the testimony of Dr. Trenkler that problems of refractory damage had not been completely solved at Gerlafingen. Dr. Trenkler testified that the damage to the converter in the June 17th series of tests influenced a

series of tests beginning June 22nd so unfavorably because of the presence of MgO from the converter lining in the bath that the decision was made to reline the converter and commence a new series of tests on June 25th. (R. 11,943.) In the June 25th series of tests, which involved a reduction in impact pressure of the jet on the bath by means of an increase of nozzle bath distance and the use of a normal nozzle rather than a Laval nozzle, no refractory damage was experienced. (DX 116, 116A.)

The contrast between the June 17th series and the June 25th series of tests at Linz with regard to refractory damage is illustrated by analyses of the magnesium oxide (MgO) content of the slag on the final steel in the converter in these tests. In the June 17th series of tests, the MgO content of the slag varied between 25.87% and 34.3%. In the June 25 tests, on the other hand, the MgO content of the slag varied between 2.08% and 11.16%. Incidentally, no such information is in evidence for the Gerlafingen tests. The significance of the MgO content of the slag lies in the fact that magnesium is not originally contained either in the pig iron or in slag additions to the heat, but comes entirely from the converter lining. The MgO content of the slag, therefore, is a significant measure of refractory wear. (Dr. Trenkler, R. 11,943, 11,943 A.) The substantially lower MgO content of the slag in the June 25th series of tests is objective [82] evidence of a considerable improvement in refractory life over the June 17th series of tests.

The marked improvement in the quality of the steel produced in regard to phosphorus removal in the June 25th series of tests without even the use of an

afterblow, and also the considerable improvement in refractory life indicate strongly to this Court that the June 25th tests at Linz represented a different and more successful process than had been practiced or disclosed by Dr. Durrer and Dr. Hellbruegge. These tests, involving a relatively low impact pressure of the jet on the bath as opposed to the recommendation of Dr. Durrer and Dr. Hellbruegge, remedied what Dr. Trenkler had stated to be the two major defects of the Gerlafingen process, namely, excessive phosphorus content in the steel produced and insufficient refractory life. (R. 11,929.)

(4) Statements by Dr. Durrer and Dr. Hellbruegge Inconsistent With Inventorship

Contemporary statements by Dr. Durrer establish clearly his own opinion that he had nothing patentable to disclose to the men at Linz with regard to an oxygen steelmaking process. In a speech given by Dr. Durrer on May 20, 1949, at Leoben, Austria (PX 307B), Dr. Durrer discussed in general terms the state of the art with regard to oxygen steelmaking. This speech was given roughly a week after Dr. Trenkler's visit to Gerlafingen, at which time defendant contends the invention of the patentees was entirely disclosed to Dr. Trenkler by Dr. Durrer and Dr. Hellbruegge. In this speech, Dr. Durrer stated:

> "What conclusions may now be drawn for the recovery of iron in Austria? In my opinion your native raw materials are suitable for smelting both in the electric low shaft furnace and in the oxygen low shaft furnace; as for the economic [83] feasibil-

ity of the problem, I, as a Swiss, cannot make any judgment, but rather only the suggestion that you investigate both procedures very thoroughly. *The question of converting pig iron into steel by means of high purity oxygen ought also to be studied;* it does not seem to be at all out of the question that this method could be of great interest for your country.

"All these ideas are still in the developmental stage, but already they indicate the direction which should be taken. In evaluating and pursuing these ideas—if we wish to do a good deed for the more distant future—we must not let ourselves be guided by monetary considerations." (Emphasis supplied.)

Dr. Durrer affirmed this statement as representing his views at that time. (R. 5098-5098A.) In the speech at Leoben, Dr. Durrer did not announce the discovery of a satisfactory steelmaking process which defendant now attributes to him, although the occasion of the speech gave him an excellent opportunity to do so had he, in fact, made such a discovery.

Dr. Durrer's speech at Leoben was delivered at a conference between representatives of four steel companies including Dr. Durrer's company, von Roll, and VOEST. According to DX 24B, a memorandum prepared by Dr. Suess setting forth conclusions of this conference it was stated:

"In conferences in Leoben from May 19 to 21, 1949, it was decided to undertake a mutual study of the question of Oxygen Blowing in iron works by the Von Roll'sche Iron Works Gerlafingen, Huetten-

werk Huckingen Ag., Alpine Montangesellschaft Donawitz and VOEST Linz. In a discussion between Prof. Durrer, Dir. Springorum, Dr. Leitner, General-direktor Oberegger, Dr. Matuschka and Suess on May 21, 1949, the following procedure was outlined as follows:

"1) All experience and know-how in this field that is or will be at the disposal of the plants, will be reciprocally put at the disposal of all.

"2) The tests that are to be carried out will be financed by the individual plants that conduct them. If the tests should be on a larger scale or if tests for other plants should be conducted, [84] then a distribution of the costs can be discussed.

"3) There will be another conference for the final setting up of this cooperation, to take place in about 4 to 5 weeks in Linz.

"4) In the near future tests will be begun in Huckingen and in Linz with the blowing of pure oxygen in converters or vessels suitable for this process.

"5) Dr. Durrer will act as secretary for this mutual undertaking."

It is difficult to understand why such an arrangement as that disclosed in the memorandum of the Leoben conference (DX 24B) would have been entered into by Dr. Durrer's company if Dr. Durrer and Dr. Hellbruegge had themselves already achieved satisfactory results with oxygen steelmaking experiments at Gerlafingen. If the Gerlafingen results had actually been satisfactory, it is more likely that Dr. Durrer's company

would have attempted to exploit commercially the new steelmaking process for its own sole benefit rather than enter into a joint experimental program with other steel companies and make available all know-how previously arrived at.

In a letter dated May 28, 1949 (DX 89B (6)), acknowledging receipt of the memorandum (DX 24B) of the Leoben conference, Dr. Durrer replied to Dr. Suess:

> "I was overjoyed by the unanimous agreement to carry out the planned joint work and I hope and trust that it will bring us the desired results. The conditions for our work are very favorable, both with regard to subject matter and with respect to the human factor and we will jointly attack the great problem in a spirit of mutual trust."

Dr. Durrer testified that the "great problem" referred to in his letter was the refining of pig iron by blowing it with oxygen. (R. 5099-5100.) However, if the Gerlafingen tests had [85] been as successful as defendant now contends, oxygen steelmaking would no longer have been such a "great problem" as Dr. Durrer apparently believed on May 28, 1949.

On June 9, 1949, a conference between representatives of the four steel companies was held at Solothurn, Switzerland, to discuss the joint work in oxygen steelmaking earlier agreed upon at the Leoben conference. Dr. Hellbruegge prepared a file memorandum (PX 301B) of the Solothurn conference two days later. In this memorandum, it is stated at p. 4:

> "With respect to possible patent applications, Dr. Durrer is of the opinion that this should be decided

only after something on which patent application can be filed is actually on hand. Furthermore, in the course of the discussion, one arrives at the opinion that it would be better to leave the individual parties free to apply for patents or not."

At trial (R. 5107), when asked the question:

"Q. So that your position as of June 9, 1949, was that nothing on which patent application could be filed was actually at hand; is that correct?"

Dr. Durrer replied:

"A. This is correct. And even today I am still of the conviction that the only basic patent for oxygen top blowing is that of Henry Bessemer.

"Q. Dated as of what date, Doctor?

"A. 1856 or 1855."

This answer indicates clearly that Dr. Durrer did not believe in June of 1949 that he had anything patentable over Schwarz or even Bessemer. (See also R. 5215.)

As previously noted, this memorandum (PX 301B) and Dr. Durrer's testimony at trial also indicate Dr. Durrer's opinion at the time of the Solothurn conference that the Schwarz patent [86] contained Dr. Durrer's ideas and that "a patent which contains my ideas does not impede me from using it." (R. 5101.)

Dr. Durrer also testified at trial that Schwarz' work gave no practical results so far as the refining of pig iron into steel by oxygen is concerned. (R. 5084-85.) It would seem to follow that if Schwarz' work led to no practical results, Dr. Durrer's ideas, allegedly contained

in the Schwarz patent, would also have led to no practical results.

It is important to note that neither Dr. Durrer nor Dr. Hellbruegge apparently sought a patent themselves on the basis of the Gerlafingen tests in the spring of 1949. Dr. Hellbruegge admitted at trial that he never filed a patent application on the work done by him concerning the top blowing of oxygen on pig iron in a converter. (R. 4970.) Records of the United States Patent Office show that Dr. Durrer executed assignments of 29 separate patent applications between May 28, 1947, and April 28, 1948 (PX 317), which indicates that he had an active interest in seeking patents. Yet Dr. Durrer admitted at trial that no patent was granted to him covering the steelmaking process experiments at Gerlafingen (R. 5215), and he also admitted that he did not himself file any patent applications (R. 5202). He further testified that he did not know whether his company had filed any such application (R. 5202-03; 5215.) However, there is no evidence in the record of any such application, either by Dr. Durrer himself or his company.

According to PX 302B, a memorandum by Dr. Suess, one of the patentees, covering a conference with Dr. Durrer and Dr. Hellbruegge on September 9 and 10, 1949, the latter two men were [87] of the opinion at that time that new patents should be applied for by the individual companies, but with benefits and participation to all the partners. The same memorandum shows that Dr. Durrer and Dr. Hellbruegge were familiar with the success of the Linz tests in June, 1949, since they thought that a large steel plant could be built at once at Linz using the same process. Apparently, therefore,

Dr. Durrer and Dr. Hellbruegge were content to allow the patentees to apply for a patent on the process at Linz rather than seek a patent themselves. Dr. Durrer was aware of the Suess patent applications in Austria and Switzerland (PX 316B, PX 312B; R. 5199-5200; and R. 5187); and yet he admitted that he never filed an opposition to Suess' applications anywhere in the world and did not remember any such opposition by his company. (R. 5218.)

In a memorandum (DX 89B (20)) dated December 14, 1949, relating to a discussion between Dr. Durrer and Dr. Suess, Dr. Durrer noted that on the basis of the excellent results of the Linz experiments, Linz had decided to construct an oxygen steel plant. Dr. Durrer further stated:

> "The good results consist in particular in the very low contents of carbon, phorphorous and sulfur, *which contradicts all metallurgical expectations. This work shows a new metallurgy with which we must first of all become acquainted.* Presumably, the extensive removal of these substances is due to the higher temperature, the higher degree of liquidity connected therewith and the higher reaction velocity resulting therefrom." (Emphasis supplied.)

This statement appears to contrast the successful work at Linz with the previous experiments at Gerlafingen. Dr. Durrer in his statement registered surprise at the good results of the Linz work, which clearly suggests that comparable results had [88] not been achieved at Gerlafingen by Dr. Durrer himself.

Also, in a letter (DX 89B (22)) by Dr. Durrer to Dr. Suess dated May 5, 1950, Dr. Durrer states:

> ". . . the very successful tests conducted by you have shown that the process based on your steel pig-iron is ready for production. I had not expected you to be able to solve this problem so quickly, and am therefore all the more delighted, now that I have been able to see the beautiful results with my own eyes. Now that the problem has been solved in principle, it is only a question in the further tests of details, of polishing up the process, so to speak . . .
>
> "To you and your co-workers my most sincere congratulations on this important metallurgical progress."

This letter must be read in light of DX 89B (21), a letter from Dr. Suess to Dr. Durrer requesting some such congratulations in order to assist Dr. Suess in his negotiations with his employer VOEST concerning the oxygen steelmaking process at Linz. Such a solicited response is not as convincing evidence of non-inventorship by Dr. Durrer himself as his memorandum (DX 89B (20)) of December 14, 1949. However, the fact that Dr. Durrer was willing to write such a letter extending his congratulations to Dr. Suess is some additional evidence of an advance in the art made by the patentees at Linz.

(5) CONCLUSION

Defendant has admitted repeatedly that the teachings of Schwarz and Dr. Durrer are essentially the same. (See, for example, p. 43 Reply Brief, R. 11,896.) On final argument, in response to the Court's statement:

> "Well, then, you admit that Schwarz and Miles and Durrer and Hellbruegge all teach the same method."

Counsel for defendant stated:

> [89] "There are minor detail differences, but so far as the basic method is concerned, they are alike as peas in a pod. There is no essential difference between them; and if we were able to urge one as doing something, we would have to admit that the other two did the same thing in broad concept." R. 13,503.)

However, defendant also admitted that Schwarz' teachings did not anticipate the patent in suit. (See, for example, R. 143-44, 13,410.) It follows that Dr. Durrer's teachings, admittedly the same as Schwarz', would also fail to anticipate the patent in suit and that Dr. Durrer could not have identically disclosed the subject matter of the patent in suit to the patentees.

It should be noted that at p. 42 of its Reply Brief, defendant attempted to confuse the issue concerning the Durrer and Hellbruegge disclosures, stating:

> ". . . the process of the patent in suit, when compared with the sum of what was learned from Dr. Durrer and Dr. Hellbruegge, must represent an advance amounting to invention."

In effect, this is a statement that the issue is one of obviousness over the Durrer and Hellbruegge disclosures and, therefore, arises under Section 103 rather than Section 102(f), upon which defendant had earlier relied. (See Main Brief, p. 223.) As already discussed, obviousness over the teachings of Dr. Durrer and Dr. Hellbruegge is not an issue in this case, since the teachings of Dr. Durrer and Dr. Hellbruegge do not constitute prior art within the meaning of the patent statute.

In conclusion, this Court finds that the defendant has failed to carry its heavy burden of proving that the patentees did not themselves invent the subject matter of the patent in suit, but rather learned it from Dr. Durrer and Dr. Hellbruegge. [90] Indeed, the evidence indicates that defendant could not have sustained even a lesser burden of proof. In the opinion of this Court, a preponderance of the evidence establishes that the patentees rather than Dr. Durrer and Dr. Hellbruegge were, in fact, the true inventors of the subject matter of the patent in suit. Such conclusion is not intended in any way to minimize the enormous contributions that Dr. Durrer and Dr. Hellbruegge made to the art of steelmaking with oxygen. The ideas and experiments of Dr. Durrer and Dr. Hellbruegge certainly paved the way for the successful experiments at Linz in June of 1949. Indeed, in any objective sense, it would have to be said that Dr. Durrer and Dr. Hellbruegge contributed as much, if not more, to the discovery of the successful oxygen steelmaking process than the patentees. However, the patentees must be credited with the invention under applicable patent law, because they took the final step of reducing impact pressue so as to avoid refractory damage and to create the early fluid slag neces-

sary for satisfactory phosphorus removal. In all other respects, the Linz process is anticipated by the work at Gerlafingen. Yet this final step of reducing impact pressure was the difference between success and failure. In this Court's opinion, Dr. Durrer and Dr. Hellbruegge themselves might well have taken the final step if they had continued their own experiments. Certainly a great deal of credit is owing to Dr. Durrer and Dr. Hellbruegge as well as to the patentees by the steelmaking industry throughout the world for their great contributions to the art of steelmaking. Nevertheless, as the Supreme Court noted in *Cimiotti Unhairing Co. v. American Fur Refining Co.*, 198 U. S. 399, 409 (1905), the patentee had "taken the step which marks the difference between a successfully [91] operating machine and one which stops short of that point, and that advance entitles him to the protection of a patent."

D. Compliance of the Specification With § 112

Defendant has attacked both the specification and the claims of the patent in suit as being too indefinite to comply with the requirements of 35 U.S.C. §112, which provides in pertinent part:

> "The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention."

Section 112 requires simply a disclosure of the invention which would enable persons skilled in the per-

tinent art to practice the invention. As the Supreme Court stated in *Mowry v. Whitney*, 14 Wall. 620, 644 (1872):

> "The specification, then, is to be addressed to those skilled in the art, and is to be comprehensible by them. It may be sufficient, though the unskilled may not be able to gather from it how to use the invention. And it is evident that the definiteness of a specification must vary with the nature of its subject. Addressed as it is to those skilled in the art, it may leave something to their skill in applying the invention, but it should not mislead them."

Thus the issue under Section 112 with respect to the specification is whether the specification describes the invention sufficiently to enable steelmakers to make and use the invention. The burden of proof on this issue, as with all issues concerning validity, is upon defendant. 35 U.S.C. § 282.

[92] Defendant has made a number of objections to language as well as particular teachings or the lack of such teachings in the specification. Such objections are of no consequence if, despite their accuracy, persons skilled in the art of steelmaking reading the patent could, nevertheless, make and use the invention disclosed by the specification "without the necessity of further experiment itself of an inventive nature." *National Battery Co. v. Richardson Co.*, 63 F. 2d 289, 293 (CCA 6, 1933); *Sun Ray Gas Corporation v. Bellows-Claude Neon Co.*, 49 F. 2d 886, 887 (CCA 6, 1931.)

As the Sixth Circuit Court of Appeals stated in *Paul E. Hawkinson Co. v. Wilcoxen*, 149 F. 2d 471, 475 CA 6, 1945), cited by both parties:

"In determining the sufficiency of these patents the real test is, whether the disclosures in the specifications and claims make the inventions clear to a mechanic skilled in the art of tire retreading so that he could construct the apparatus and practice the method."

In this connection, Dr. Flinn, Professor of Metallurgical Engineering at the University of Michigan, who testified for defendant, admitted that a person skilled in the art could follow the teachings of the examples set forth in the specification and manufacture satisfactory steel. (R. 7885 and 7924.) The examples of the specification were limited to heats of 35 to 36 tons. Dr. Flinn was questioned as follows:

"Q. And the specific conditions there are given for 36-ton heats; right?

"A. Yes.

"Q. And if you follow those specific teachings, you get good steel; right?

"A. Yes." (R. 7924.)

[93] Dr. Flinn also testified that a steelmaker would have difficulty in making good steel following the teachings of the patent with respect to heats of sizes larger or smaller than the 36-ton example. Specifically, he testified:

"A. I think I would have to do a fair amount of experimenting, . . ." (R. 7938.)

The specification teaches a broad range of operating conditions which would cover larger or smaller heats. However, the patent does not give precise numerical teachings such as oxygen blowing pressure or nozzle bath distance to be used for heats of particular sizes

other than 36 tons. The patent states at col. 9, lines 13-17:

> "In general, it may be stated that as the oxygen pressure and nozzle diameter are increased, the nozzle spacing is also increased, for example, as the capacity of the refining vessel and total charge is increased."

According to Dr. Flinn, such teaching would not provide sufficient guidelines to persons skilled in the art desiring to manufacture steel in heat sizes of other than 36 tons. In any event, there seems to be no question that the 36-ton heat example of the specification has "set forth the best mode contemplated by the inventor of carrying out his invention," as required by Section 112.

Section 112 does not expressly require a disclosure of the invention so full and comprehensive that a person skilled in the art would not have to engage in any experimentation whatever to make and use the invention for his own particular purposes. Further experimentation of the sort in which Dr. Flinn felt the need to engage in order to make more than 36 tons of steel at a time is not condemned by Section 112, provided that such experimentation is not itself of an inventive nature. *National Battery* [94] *Co. v. Richardson Co., supra,* 63 F. 2d 289, 293 (CCA 6, 1933.)

As the Sixth Circuit Court of Appeals recently stated in *Tilotson Manufacturing Co. v. Textron, Inc., Homelite,* 336 F. 2d 833, 841 (CA 6, 1964):

> "A specific example of the carburetor was given in the specification. The fact that some testing may be required in calibrating carburetors for different

> engines does not render the claims indefinite where adequate guideposts were furnished as here."

The real question, therefore, is whether the experimentation required to make satisfactory steel in heat sizes larger or smaller than the 36-ton example of the specification would be experimentation "of an inventive nature." In view of the teaching in the specification of a broad range of operating conditions for heats of various sizes and the instruction of col. 9, lines 13-17, that oxygen pressure and nozzle diameter are to be increased along with nozzle bath distance as the size of the heat is increased, and also in light of the general teaching at col. 3, lines 70-75, to avoid deep penetration so as to obtain a fluid slag and to avoid slopping, this Court concludes that the experimentation required to go to a different heat size would not be of an inventive nature. The specification teaches "necessary and required process conditions, such as fluid slag . . . and avoidance of slopping" (col. 3, lines 70-73), indicating the avoidance of a deep penetration. The specification also gives a broad range of operating conditions and an instruction as to their interrelation which would inform the steelmaker in general of the method of obtaining good steel in various heat sizes.

Significantly, McLouth's OP-2 shop, constructed in [95] 1958 and 1960, contains vessels with a capacity of 110 tons (R. 10,957), a considerably larger capacity than that of the OP-1 shop. Mr. Johnson, McLouth's Vice President in charge of engineering, and responsible for the design and construction of McLouth's OP-1 and OP-2 shops (R. 10,950-51), was not examined at trial by defendant concerning the alleged indefiniteness of the

specification, although he would have been the most qualified of defendant's witnesses to testify on this issue. However, plaintiffs put in evidence certain pertinent testimony from Mr. Johnson's deposition taken prior to trial. He apparently encountered no difficulty in going from the heat used in the OP-1 shop to the larger heat used in the OP-2 operation. Specifically, he testified at R. 3494-3497:

"Q. Now, just how did you determine the oxygen flow rates to be used on the 80 and 100 ton vessels in the No. 2 Shop?

"A. We believed from our experience on our No. 1 vessel that we had established certain maximum conditions. If you will remember from the interrogatories, it is necessary in the first few heats of the lining, for example, in Vessel No. 1 to charge for a 52-ton tap instead of a 60-ton. So that we believe that these vessels at our OP-1 Shop are operating at a limiting condition and that this was, I believed, good information, because many of us discussed this problem of limiting size, and to me, of course, the designer, the limit size is a very important number. I thought that we had established these conditions there so it was a simple extrapolation from these maximum conditions that we had determined from our operations.

"Q. What were these maximum conditions that you speak of? What did they relate to?

"A. Principally to depth of bath.

"Q. Flow rates also?

[96] "A. On flow rates also, in the respect that if depth of bath is established, then we would have an extrapolation of oxygen volume also.

"Q. Just how did you make that extrapolation in regard to the oxygen flow?

"A. In comparing tons of metal blown in the two vessels. The actual history is straight extrapolation gas from medium range 3400 to 5700, and considering an 80-ton heat size; and sometime after the units were built, because our operation was in the high part of the range, it was necessary for us to rebuild the oxygen controlling devices, so that the instruments would be more comfortably in the center of the range.

* * *

"Q. And what was the actual designed flow rate that you got by this extrapolation for the 100-ton vessel?

"A. On the 100 ton?

"Q. Yes.

"Mr. Groner: You mean by that the A. vessel?

"Mr. Webb: Yes.

"A. We in effect did not actually design that, Mr. Webb. The equipment, except for the vessel height, and the fact that we knew the flow meter range was not high enough, the equipment was purchased as being identical equipment, and the instruments for that vessel were bought to handle a higher-range, but we actually did not establish any number. We did not perform tests of lances or establish numbers for A Vessel. It was a simple addition of similar equipment with some improvement."

Mr. Johnson's testimony quoted above concerned primarily the specific features of oxygen flow rate and bath depth. However, there is no reason to assume that he would have given a different answer with respect to other operating factors, keeping in mind defendant's burden of proof on this issue and its failure to call Mr. Johnson as its own witness on this issue. In short, [97] according to defendant's own testimony, persons skilled in the art can make satisfactory steel following the teachings of the 36-ton heat example given in the specification, and a person skilled in the art can apparently extrapolate from such conditions to determine the operating conditions for larger heat sizes.

Additionally, Dr. Elliott demonstrated the manner in which a person skilled in the art of steelmaking in 1950, reading the patent, would be able to design operating conditions for a 100-ton heat. (PX 347; R. 6174-6245.) Such evidence was not refuted by defendant.

The above testimony is sufficient to resolve the issue of indefiniteness of the specification under Section 112. Therefore, this Court need not discuss in great detail defendant's various objections to the specification.

Defendant objects to the language referring to avoidance of deep penetration as a fiction and also a meaningless term. However, it has already been observed that the specification gives the phrase "avoidance of deep penetration" a special meaning by association with "necessary and required process conditions, such as fluid slag, avoidance of over-oxidation (undue loss of iron to the slag), and avoidance of slopping." (Col. 3, lines 70 to 73.) The patent further states: "The process conducted under these conditions

avoids a deep penetration of the oxygen gas into the molten bath which seriously impairs refractory life at the bottom of the refining vessel." (Col. 3, line 73, to col. 4, line 1.) Thus, according to the teaching of the specification, a steelmaker knows he is avoiding deep penetration within the meaning of the patent if he does not blow deeply enough to [98] cause refractory damage or to prevent the formation of a fluid slag, as Dr. Elliott and Dr. Hauttmann testified. (R. 6168-70; R. 2764.) Given this special meaning by the specification, the phrase "avoidance of deep penetration" is certainly not a fiction, since such process conditions as a fluid slag, the avoidance of slopping and the avoidance of refractory damage are admittedly part of the practice of steelmaking at McLouth. (R. 3483-85; 6692-93; 10,-986-92; 11,190-91.)

Defendant also complains that the expressions in the patent relating to "surface blowing" are fatally indefinite. Defendant contends that surface blowing means absence of any penetration whatever by the jet. Such a construction of the term "surface blowing" is inconsistent with the teachings of the patent to avoid deep penetration, which admittedly implies some penetration by the jet (R. 854), at least sufficient penetration to avoid slopping as specifically taught at col. 3, lines 70 to 75. Moreover, as Dr. Hauttmann testified:

> "The words 'surface blowing' only says [sic] that the jet is directed toward the surface, in contrast to what happens if a nozzle or an oxygen jet is blown from below directly into a melt." (R. 2494; see also Dr. Chipman, R. 959-60.)

Defendant's witness Dr. Flinn also recognized this distinction. (R. 8043.)

Defendant objects to the language in the specification referring to the "confined" or "localized" reaction zone as fatally indefinite. It is true that the specification gives the term no precise meaning or definition, at least in terms of numerical percentage of bath area or depth. However, the specification does make clear that the reaction zone must not be [99] of sufficiently large size to cause excessive refractory damage either to the bottom or walls of the vessel. (See, e.g., col. 3, line 73, to col. 4, line 6.) Although the term lacks precision, its indefiniteness would not prevent a steelmaker from making and using the invention on the basis of the disclosures of the specification. As Dr. Chipman testified, a localized reaction zone is characteristic of the process, and cannot be avoided in any event. (R. 907.)

Defendant objects to the alleged inadequacy of the teaching of the specification concerning the interrelation of the broad range of operating conditions taught by the patent. As already noted, the patent teaches at col. 9, lines 14 to 17, that "as the oxygen pressure and nozzle diameter are increased, the nozzle spacing is also increased, for example, as the capacity of the refining vessel and total charge is increased." Defendant contends that such teaching is not helpful because it does not teach to what extent the various operating conditions should be increased. The short answer to this contention is that the specification is directed to persons skilled in the art of steelmaking who, according to plaintiffs' witnesses at least, would be able to make the necessary correlation. As already discussed, experi-

mentation itself of an inventive nature would not be required to arrive at the appropriate correlation of operating conditions for heats of various sizes.

With regard to circulation, defendant contends that the patent's teaching of a down in center circulation is a teaching of a circulation that does not exist in fact. However, such a contention raises no problem under Section 112 concerning definiteness of the specification. The specification as a whole [100] might well be sufficiently definite to enable a steelmaker to make and use the invention, although one portion of the specification suggested a nonexistent phenomenon. Thus, the Court need not decide with respect to this issue whether circulation down in the center exists in fact, as suggested by the specification.

Defendant also objects to an allegedly inadequate disclosure in the specification concerning an appropriate nozzle. However, it was apparently the intent of the patentees that either the Laval nozzle or a normal converging nozzle could be used. (R. 11,906.) Defendant's counsel (R. 124) and its witness, Dr. Flinn (R. 8015), admitted that either a Laval or cylindrical nozzle could be used in practicing the patent process. Therefore, the failure of the patent to specify one type or the other as appropriate raises no issue under Section 112.

Defendant contends that the patent teaching with respect to nozzle diameter is erroneous. At col. 3, lines 59-61, the patent teaches a diameter of about one millimeter per ton of charge, which teaching plaintiffs admit would not apply universally to all heat sizes. (E.g., R. 6423-24.) However, plaintiffs' witnesses testified

that persons skilled in the art would not be misled by the patent teaching regarding nozzle diameter and would be able to compute a proper diameter for the desired heat size. (R. 6664-65; 2472-73.) Defendant has not sustained its burden of proving the contrary. Errors in a patent specification do not render a patent fatally indefinite under Section 112 if such errors do not mislead persons skilled in the art. *International Nickel Company v. Ford Motor Company,* 166 F. Supp. 551, 557 (S.D. N.Y., 1958).

Further, defendant objects to the many references in [101] the specification concerning "high temperatures" in the localized reaction zone as being too indefinite for failure to specify such temperatures in degrees. Again, such objection raises no issue under Section 112, although the term "high temperature" is indefinite, since the indefiniteness of the term in no way would impair the ability of a person skilled in the art to make and use the invention on the basis of the disclosure in the specification.

As the Supreme Court stated in *Eibel Process Company v. Minnesota & Ontario Paper Company,* 261 U. S. 45, 66 (1923):

> "Expressions quite as indefinite as 'high' and 'substantial' in describing an invention or discovery in patent specifications and claims have been recognized by this Court as sufficient."

Dr. Chipman testified that blowing vertically into a bath, a steelmaker cannot avoid the high temperatures referred to in the specification. (R. 1017.)

Finally, defendant refers to several admitted errors in the teachings of the specification. However, defendant has not sustained its burden of proving that such minor errors would mislead persons skilled in the art to such an extent that they would not be able to make and use the invention disclosed by the specification.

In sum, this Court finds that the specification of the patent in suit, despite certain indefiniteness and inaccuracies, nevertheless complies with Section 112 by disclosing the invention in sufficiently clear terms to enable steelmakers "to make and use the same." At least defendant has not sustained its burden of proving otherwise, especially in light of defendant's own testimony that persons skilled in the art could make satisfactory steel following the teachings of the example and that [102] extrapolation to other heat sizes was a simple matter. Defendant's failure to call its own steelmakers as witnesses on this issue weakens its attack on the specification under Section 112.

E. Compliance of the Claims With § 112

35 U.S.C., Section 112, provides in pertinent part:

> "The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention."

Defendant in this case has attacked the claims of the patent in suit as being too indefinite to determine the scope and content of the invention claimed and also as not supported by the specification. There is another objection, not separately argued by the defendant, that the claims do not cover the actual invention by the patentees, as required by Section 112.

(1) THE CLAIMS DO NOT MEASURE THE INVENTION

It has already been noted in connection with the issues of nonobviousness and inventorship that all four of the patentees at one time or another considered a reduced impact pressure of the jet on the bath or the avoidance of a deep penetration of the bath by the jet to be the gist of their invention. (Rinesch affidavit DX 116; Hauttmann affidavit DX 117; R. 2772-73; Trenkler testimony R. 11,904, 11,912 and 11,942; Suess Austrian application PX 2C; U. S. continuation-in-part application PX 2A, claims 1-4; and the German File Wrapper History PX 93B, pp. 31-32 and 41.) For example, Dr. Trenkler defined the invention as follows:

> "A. *In our method we blow only on the surface and a little below.* I do not think I can state that very shortly. It will be about two to three sentences.

"Q. All right.

[103] "A. *Owing to this type of blowing to the upper regions of the bath,* we have an essentially earlier dissolution of the lime, a higher Fe content in the slag, and thereby a faster and better dephosphorization. Owing to the fact that the hot zone caused by the top blowing of oxygen is not deep in the bath, the lining is protected. The third and the last sentence comes now.

"Q. Go ahead.

"A. Owing to the fact that the phosphorus content, that is, the phosphorus burns earlier, that is, prior to the combustion of carbon, we have until the end of the process a carbon monoxide evolution which results in an essentially better movement of the bath than the one that would be caused by the oxygen jet." (R. 11,904. Emphasis supplied.)

The specification of the patent in suit teaches the avoidance of deep penetration as an essential characteristic of the process of the patent. (Col. 3, lines 46, 74; col. 4, line 70, col. 9, line 18.) Further, plaintiffs in this litigation have repeatedly contended that the "new mental concept" that differentiates the invention of the patentees from the prior art Schwarz and Miles patents, and also the teachings of Dr. Durrer and Dr. Hellbruegge, was a reduction in impact pressure so as to avoid the deep penetration suggested by the prior teachings. (See e.g. Plaintiffs' main brief, pp. 37 to 43; reply brief, p. 27; final argument R. 13,184-88; 13,214; 13,269-79.)

At R. 13,187-88, counsel for plaintiffs said:

"They [the patentees] learned that you have to avoid the deep penetration; . . . in other words, they had to reduce the impact pressure.

* * *

". . . They arrived at this thought: 'That maybe we've got to blow this from a higher point. Maybe we've got to cause this oxygen to impinge on the surface of the bath with a lower impact pressure and avoid stirring the bath by the oxygen stream, so what we'll do is to use another nozzle, and we'll also raise the lance further above the bath level.' "

[104] Additionally, at R. 13,769-70, the following colloquy occurred:

"*[Counsel for Plaintiffs]*: The gist of the affidavits, I would say, your Honor, is, if I may summarize it rather quickly, that the primary difference between the L-D process and the process of Schwarz and Miles, which never got anywhere, is that in both Schwarz and Miles they teach deep penetration as a necessity, whereas in the L-D process you avoid deep penetration.

"*The Court*: Isn't that the real gist of the difference between the patent in suit and Schwarz and Miles? Isn't that the real gist?

"*[Counsel for Plaintiffs]*: Yes, your Honor.

"*The Court*: Of the difference?

"*[Counsel for Plaintiffs]*: Yes, your Honor. And that is the thing which is stated here in the affidavits, and the affidavits do not point out that it was a new kind of nozzle, a different kind of

nozzle that is the crux of the invention. The affidavits point out that the crux of the invention was reducing the pressure of the oxygen on the melt so that you did not have this deep penetration.

"*The Court*: That would be the advance in the art, then, over Schwarz and Miles?

"*[Counsel for Plaintiffs]*: I think that is an important feature of it, as I indicated earlier.

"*The Court*: Are there any others?

"*[Counsel for Plaintiffs]*: Beg pardon?

"*The Court*: Are there any others?

"*[Counsel for Plaintiffs]*: Well, I think, as I pointed out the other day in our main brief, we pointed out a number of other distinctions between Schwarz and Miles—

"*The Court*: But that is the main difference?

"*[Counsel for Plaintiffs]*: Yes."

Also, plaintiffs' proposed finding of fact No. 31 speaks of the "new concept of non-deep penetration." There is no question on the state of this record that plaintiffs have repeatedly [105] stated the avoidance of deep penetration of the bath by the oxygen jet to be the gist of their invention. Indeed, such a position was essential to rebut the defenses of anticipation, obviousness and non-inventorship. Plaintiffs, having taken this position as to the true nature of the invention to rebut such defenses, are now bound by their position, which, as already discussed at length, is well-supported by the evidence in the record.

For a valid patent, Section 112 requires a statement of claim or claims which particularly point out and distinctly claim the subject matter which the applicants regard as their invention. In the instant case, the avoidance of deep penetration is clearly the subject matter which applicants regarded as their invention, and yet the concept of the avoidance of deep penetration simply cannot be read into the claims of the patent in suit. The language of the claims admittedly does not refer expressly to the avoidance of deep penetration of the bath by the jet (R. 13,772), nor can any language of the claims be construed to contain such a meaning.

The claims of the patent in suit speak of "discharging a stream of oxygen vertically downwardly through the slag layer onto and below the surface of the bath at the central portion thereof." Such language is clearly not restricted to a non-deep penetration and could include a penetration far below the surface of the bath.

Plaintiffs rely on language in the claims referring to the avoidance of "material agitation of the bath by the oxygen stream" and "a localized reaction zone spaced a substantial distance from the refractory lining" as incorporating the concept [106] of the avoidance of deep penetration. (R. 13,772-73.) However, these references cannot be so construed.

On the state of this record, this Court is obliged to conclude that the avoidance of deep penetration by the jet is not necessarily causally related to the claim of avoiding "material agitation of the bath by the oxygen stream." In other words, it appears to this Court that even deep penetration would avoid material agitation as defined by plaintiffs. The lack of any causal relation

between deep penetration and material agitation by the jet, or at least the lack of any showing of such relation in this record, will be discussed fully in another connection. (See *infra* II. E. (2) (a).) It is sufficient at this point to observe that no such causal relation has been established in this record that would entitle plaintiffs to read the avoidance of deep penetration into the language of the claims referring to the avoidance of material agitation of the bath by the oxygen stream.

As for the "localized reaction zone spaced a substantial distance from the refractory lining," such a reaction zone could also exist even with deep penetration. Indeed, the Schwarz and Miles patents which taught deep penetration also referred at least indirectly to the existence of such a reaction zone a substantial distance from the refractory lining. (DX 61, Schwarz, pp. 4-5; Miles, pp. 3, 15, 16.) Deep penetration of the bath by the oxygen jet as taught by Schwarz and Miles might well extend to a depth of two-thirds of the bath, for example, still leaving a "substantial distance" of one-third of the bath depth between the reaction zone and the refractory lining. The term "substantial distance" is not given any definite meaning by the patent [107] in suit, and the patent certainly does not teach that one-third of the bath depth, for example, would not be a "substantial distance" within the meaning of the claims. Thus plaintiffs cannot read the avoidance of deep penetration into the language of the claims referring to "a localized reaction zone spaced a substantial distance from the refractory lining."

There is a further reason why the actual invention of the patentees cannot be read into the claims of the

patent in suit. Claims 1 through 4 of the continuation-in-part application, which expressly mentioned the avoidance of deep penetration as an essential feature of the claimed invention, were rejected by the Patent Office and later cancelled by the applicants. (PX 2A.) Instead of pressing claims which expressly mentioned the avoidance of deep penetration by resubmitting such claims and eventually even appealing further rejections, if necessary, the applicants abandoned the use of language referring to the avoidance of deep penetration and later chose to submit the language of the claims as finally approved by the Patent Office, resulting in the issuance of the patent in suit. Therefore, the well-established doctrine of file wrapper estoppel prohibits a construction of the claims finally approved by the Patent Office as containing a concept expressed in language previously rejected by the Patent Office and then abandoned by the applicants. As the Supreme Court stated in *Schriber-Schroth Co. v. Cleveland Trust Co.*, 311 U.S. 211, 220-21 (1940):

> "It is a rule of patent construction consistently observed that a claim in a patent as allowed must be read and interpreted with reference to claims that have been cancelled or rejected, and the claims allowed cannot by construction be read to cover what was thus eliminated from the patent. [108] *Shepard v. Carrigan*, 116 U. S. 593; *Sutter v. Robinson*, 119 U. S. 530; *Roemer v. Peddie*, 132 U. S. 313; *Phoenix Caster Co. v. Spiegel*, 133 U. S. 360; *Hubbell v. United States*, 179 U. S. 77; *Weber Electric Co. v. E. H. Freeman Electric Co.*, 256 U. S. 668; *I.T.S. Rubber Co. v. Essex Rubber Co.*, 272 U.S. 429, 443. The patentee may not, by resort to the

doctrine of equivalents, give to an allowed claim a scope which it might have had without the amendments, the cancellation of which amounts to a disclaimer. *Smith v. Magic City Club,* 282 U. S. 784, 790; *Weber Electric Co. v. E. H. Freeman Electric Co., supra,* 677, 678; *I.T.S. Rubber Co. v. Essex Rubber Co., supra,* 444. The injurious consequences to the public and to inventors and patent applicants if patentees were thus permitted to revive cancelled or rejected claims and restore them to their patents are manifest. See *Leggett v. Avery,* 101 U.S. 256, 259.

"True, the rule is most frequently invoked when the original and cancelled claim is broader than that allowed, but the rule and the reason for it are the same if the cancelled or rejected claim be narrower. *Morgan Envelope Co. v. Albany Paper Co.,* 152 U. S. 425, 429; *Wm. B. Scaife & Sons Co. v. Falls City Woolen Mills,* 209 F. 210, 213; see *Computing Scale Co. v. Automatic Scale Co.,* 204 U. S. 609, 620, 621; cf. in case of disclaimer *Altoona Publix Theatres, Inc. v. Tri-Ergon Corp.,* 294 U. S. 477, 492, 493."

It is unfortunate that the applicants adopted a course of conduct in the prosecution of their continuation-in-part application which resulted in the creation of such an estoppel. This Court is convinced on the state of this record that the "new mental concept" of the patentees to avoid a deep penetration of the bath by the jet was a patentable advance in the art of steelmaking, which explains the adoption of the Linz oxygen steelmaking process by steelmakers throughout the

world. Thus, if the applicants had pressed their claim of avoidance of deep penetration in the Patent Office, so as to particularly point out and distinctly claim the subject matter which the applicants actually regarded as their invention, a valid patent might well [109] have issued. In actual fact, however, the subject matter which the applicants regarded as their invention cannot be read into the language of the claims of the patent in suit and, therefore, the claims do not comply with the requirements of Section 112 for failure to particularly point out and distinctly claim the actual invention of the patentees. "The omission of an indispensable step of a process renders a claim invalid." *Technograph Printed Circuits, Ltd., v. Bendix Aviation Corp.*, 218 F. Supp. 1, 44 (D. Md. 1963), affirmed 327 F. 2d 497 (CA 4, 1964), cert. den. 379 U. S. 826 (1964); citing *Aluminate Co. v. Akme Flue, Inc.*, 50 F. 2d 921 (D. Md. 1931); *Daniel Green Felt Shoe Co. v. Dolgeville Felt Shoe Co.*, 210 F. 164 (CCA 2, 1913); *Pennsylvania Crusher Co. v. Bethlehem Steel Co.*, 193 F. 2d 445 (CA 3, 1951); *Western States Machine Co. v. S. S. Hepworth Co.*, 147 F. 2d 345 (CA 2, 1945), cert. den. 325 U. S. 873 (1945). See also *Ideal Roller & Mfg. Co. v. Sutherland Paper Co.*, 96 F. 2d 675, 677 (CCA 6, 1938). Since the avoidance of deep penetration is clearly an indispensable step and indeed the very gist of the invention, its omission from the claims of the patent in suit renders the claims invalid and the patent in suit must, therefore, be held invalid for this reason alone.

(2) THE CLAIMS ARE NOT SUPPORTED BY THE SPECIFICATION

The claims of the patent in suit are a classic example of what Mr. Justice Fortas in the recent case of *Brenner v. Manson,* 383 U. S. 519, 534 (1966), described as "the highly developed art of drafting patent claims so that they disclose as little useful information as possible — while broadening the scope of the claim as widely as possible." But it is a well-established [110] principle of patent law that the claims of a valid patent must be supported by the specification. As the Supreme Court said in *Schriber-Schroth Co. v. Cleveland Trust Co.,* 305 U. S. 47, 57 (1938):

> "The object of the statute is to require the patentee to describe his invention so that others may construct and use it after the expiration of the patent and to 'inform the public during the life of the patent of the limits of the monopoly asserted, so that it may be known which features may be safely used or manufactured without a license and which may not.' *Permutit Co. v. Graver Corporation,* 284 U. S. 52, 60. It follows that the patent monopoly does not extend beyond the invention described and explained as the statute requires, *Permutit Co. v. Graver Corporation, supra, at* 57; that it cannot be enlarged by claims in the patent not supported by the description, *Snow v. Lake Shore & M. S. Ry. Co.,* 121 U. S. 617; cf. *Smith v. Snow,* 294 U. S. 1; and that the application for a patent cannot be broadened by amendment so as to embrace an invention not described in the application as filed, at least when adverse rights of the

public have intervened. *Railway Co. v. Sayles,* 97 U. S. 554, 563, 564; *Powers-Kennedy Corp. v. Concrete Co.,* 282 U. S. 175, 185-186; cf. *Webster Electric Co. v. Splitdorf Electrical Co.,* 264 U. S. 463; *Permutit Co. v. Graver Corporation, supra; Crown Cork & Seal Co. v. Gutmann Co.,* 304 U. S. 159."

In the instant case, several steps of the claims of the patent in suit are not supported by the specification, as required.

(a) *The avoidance of "material agitation of the bath by the oxygen stream"*

The term "material agitation" or "avoidance of material agitation" is admittedly not used or defined in the specification of the patent in suit. (R. 13,326, 13,-327, 13,328; also plaintiffs' main brief, p. 190; Dr. Chipman, R. 879; Dr. Elliott, R. 6627; Dr. Hauttmann, R. 2412.) For example, when Dr. Chipman was asked: "Do you find any teaching anywhere in the patent of [111] the avoidance of material agitation by the oxygen stream during the blow?", he finally answered: "I must reply that I do not know, but that I have been unable in the time I have spent here to locate it." (R. 877-78.)

Also, at R. 880, the following exchange occurred:

"Q. . . . do you find any teaching in the patent of what is material agitation, or material agitation produced by the oxygen stream, physically?

"A. I see no definition of it.

"Q. You don't know from anything in the patent when a harmless agitation becomes a material agitation, do you, Doctor?

"A. I don't think so."

After Dr. Chipman testified that the patentees advised against material agitation by the jet, he was asked the location of such teaching and replied:

"A. It is illustrated in the claims. Whether it is elsewhere, I don't know.

"Q. That's pretty important, Doctor. Do you want to look a little further?

"A. No. It is either there or it isn't.

"Q. Well, is it? You have qualified as an expert on this patent. I want your answer.

* * *

"A. The advice is implied rather than explicit.

"Q. You can't find any such advice, can you, Doctor?

"A. No, not explicit." (R. 886-87.)

Plaintiffs attempted to avoid the effect of such omission by citing the case of *A. S. Boyle Co. v. Harris-Thomas Co.*, 18 F. Supp. 177, 181 (D. Mass. 1937) for the proposition that "The patentee is not bound to use in his claims the precise [112] phraseology with which he sets forth the invention in his specification." It is true that the same "precise phraseology" is not required, but there must be at least some antecedent language in the specification to support the claim. No such language can be found in the specification of the patent in suit.

There is only one reference in the specification which appears to this Court to relate to the claim of avoidance of material agitation of the bath by the oxygen stream. As already mentioned, at col. 6, lines 66 to 72, the patent teaches that at the end of the blow, when carbon combustion has been completed, "the bath becomes relatively quiet," and "the turbulence of the

bath and slag due to the oxygen stream impinging from directly above is insufficient to cause continuance of oxygen-metal reactions." Plaintiffs rely on such quieting of the bath at the end of the blow as evidence of the avoidance of material agitation of the bath by the jet. (E.g., main brief, pp. 262-68.) Such reference in the specification to the quieting of the bath would give only a very restricted meaning to the concept of avoidance of material agitation. Under the teaching of such reference, the material agitation of the bath to be avoided would be that amount of agitation by the jet which would suffice to prevent quieting of the bath or to cause continuance of oxygen-metal reactions at the end of the blow when carbon combustion has been completed. The Court can attribute no more meaning than this to the language of the claims concerning the avoidance of material agitation, at least on the basis of the teaching of the specification. And since, as a matter of fact, it has not been established that there could ever actually be an agitation by the jet that would prevent such quieting of the bath at the end of the [113] blow, the avoidance of material agitation so defined would appear to be inevitable.

In support of the claim of avoidance of material agitation, plaintiffs also rely upon the teaching of the specification in col. 3, lines 37 to 40, that the jet is blown vertically downward upon the central portion of the bath. According to the undisputed testimony of Dr. Elliott (R. 6162) and also Dr. Chipman (R. 1066), such positioning of the lance results in the least possible amount of agitation of the bath by the oxygen stream. In other words, any other placement of the lance, either

at an angle or off center, would increase the agitation of the bath by the mechanical action of the oxygen stream. Such teaching of vertical blowing does not provide adequate support for the claim of avoidance of material agitation by the jet, since the teaching of vertical blowing toward the center of the bath is itself expressly referred to in the claims by the language: "discharging a stream of oxygen vertically downwardly through the slag layer onto and below the surface of the bath at the center portion thereof." Therefore, if the concept of avoidance of material agitation were supported only by the teaching of vertical blowing at the bath center, the language of the claims concerning avoidance of material agitation would be merely surplusage. Further, it is clear from the claims that the language concerning avoidance of material agitation must be read with reference to penetration by the jet, rather than placement of the lance, since the claim speaks of blowing "onto and below the surface . . . to an extent to avoid material agitation of the bath by the oxygen stream."

[114] Plaintiffs find primary support for the claim of avoidance of material agitation by the oxygen stream in the teaching of the specification to avoid deep penetration, relying on the testimony of Dr. Elliott, a Professor of Metallurgy at Massachusetts Institute of Technology who testified for plaintiffs, that the avoidance of deep penetration results in the avoidance of material agitation of the bath by the jet (R. 6162-66.) However, plaintiffs have admitted that the specification does not expressly teach any such correlation. In final argument, for example, the following colloquy occurred:

"*[Counsel for Plaintiffs]*: . . . And then we have the teaching in regard to the avoidance of deep penetration.

* * *

"And, of course, where you avoid deep penetration you avoid this material agitation of the bath by the oxygen stream.

"*The Court*: Yes, that is what you say. That is true. But the specification doesn't use that language.

"*[Counsel for Plaintiffs]*: That is correct.

"*The Court*: It doesn't say that if you avoid deep penetration that material agitation would be avoided. It doesn't say that in so many words.

"*[Counsel for Plaintiffs]*: That is correct, your Honor." (R. 13,329.)

According to Dr. Elliott's testimony (R. 6638-42), the specification of the patent in suit teaches a correlation between the avoidance of deep penetration and the avoidance of material agitation at six different places. The Court concludes on examination of the six references cited by Dr. Elliott, and hereinafter referred to, that no such correlation is in fact taught by the specification. At col. 3, lines 37 to 50, the [115] patent teaches only vertical blowing without deep penetration so as to produce "a relatively confined zone of direct oxygen to molten metal contact with respect to the total surface area of the bath." Agitation of the bath by the jet is not mentioned. At col. 4, lines 26 to 38, the patent teaches only that vertical blowing brings about a circulation of the bath down in the center away from the

localized reaction zone. Again, agitation of the bath by the jet is not mentioned. At col. 4, lines 54 to 67, the patent teaches that agitation of the bath caused by chemical reactions in the localized reaction zone augments a pre-existing circulation of the bath brought about by the jet. Agitation of the bath by the jet is again not mentioned or said to be insignificant in comparison with agitation caused by chemical reactions. At col. 6, lines 69 to 73, the patent teaches that once carbon combustion is completed, "The turbulence of the bath and slag due to the oxygen stream impinging from directly above is insufficient to cause continuance of oxygen-metal reactions." This language is the sole reference in the specification of the patent to an agitation of the bath by the jet. In this reference, no mention is made of the depth of penetration. Certainly this reference does not expressly teach that only the avoidance of deep penetration results in the avoidance of material agitation of the bath by the oxygen stream. No causal relation between deep penetration and material agitation is taught. The other two references cited by Dr. Elliott at col. 9, lines 6 to 14, and in col. 10 of the patent specification, merely give some exemplary blowing information for heats making good steel, and the references teach nothing expressly about either penetration or agitation by the jet.

[116] Thus on close examination, none of the references relied on by plaintiffs teach any causal relation between deep penetration and material agitation by the oxygen stream. Plaintiffs merely assume that the two concepts are causally related. However, if such an assumption is not taught by the specification itself, then persons skilled in the art of steelmaking reading the pat-

ent are not informed of the meaning of language in the claim referring to the avoidance of material agitation by the oxygen stream.

Further, as already discussed, the doctrine of file wrapper estoppel prevents a reading of the claim of avoidance of material agitation as supported by the specification's teaching of avoidance of deep penetration, since claims previously submitted by the applicants which had expressly referred to the avoidance of deep penetration were rejected by the Patent Office and later cancelled. (PX 2A.)

Significantly, no causal relation between the avoidance of deep penetration and the avoidance of material agitation was expressed anywhere in the file wrapper history of the patent in suit until June 11, 1957, when the affidavits of Dr. Rinesch and Dr. Hauttmann (DX 116, 117) were filed in the Patent Office. On the same date, the language of the claims concerning the avoidance of material agitation by the oxygen stream was presented to the Patent Office for the first time. The affidavits and the new language of the claims were clearly submitted to the Patent Office in response to its rejection of previous claims in light of the Miles patent, which taught that the jet agitated the bath. (DX 61, Miles, p. 18.) The language of the new claims concerning the avoidance of material agitation was, therefore, an obvious attempt [117] to distinguish the Miles patent. In a letter to the Patent Office submitted together with the affidavits and the new claims, counsel for the applicants stated:

> "It will be appreciated that the conditions of the reaction and for practicing the method are very

> different, indeed, from anything shown in the prior art and particularly the process disclosed in the Miles et al. French patent." (PX 2A, p. 77.)

At the time the new claims were submitted, no changes were made in the specification.

Plaintiffs contend that the specification must be construed in light of what it would teach persons skilled in the art, and argue further that persons skilled in the art of steelmaking would know what was meant by the language of the claims referring to the avoidance of material agitation by the oxygen stream. In this regard, it is unquestionable that the sufficiency of a specification in a patent application must be tested in light of what it conveys to those who are skilled in the pertinent art at the time the invention was made, *Application of Wilke,* 314 F. 2d 558, 565 (C.C.P.A. 1963).

The evidence established that the concept of avoidance of material agitation of the bath by the jet would not have been meaningful to persons skilled in the art at the time the invention was made. The Schwarz and Miles patents do not mention the concept of "material agitation" and neither patent teaches any causal relation between deep penetration and material agitation. The Miles patent does teach that the jet agitates the bath (DX 61, Miles, p. 18) but does not expressly teach deep penetration. Certainly Miles does not teach that *only* deep penetration would agitate the bath materially. Thus, even if the contenton of the [118] Rinesch and Hauttmann affidavits in 1957 that only deep penetration causes material agitation were accepted by this Court, the patent teaching of the avoidance of deep penetration would still not suffice under Section 112 to support the

claim of avoidance of material agitation, since persons skilled in the art of steelmaking at the time the invention was made reading the patent would not be aware of any such causal relation and would, of course, not be responsible for knowing the contents of affidavits filed more than seven years later.

Further, plaintiffs have defined material agitation by the jet as agitation sufficient to overcome circulation created by chemical reactions. (Main brief, pp. 191-92; R. 13,331-32. See also Dr. Chipman, R. 889-900A, 1064, 1066; Dr. Elliott, R. 6167.) However, there is no evidence that in 1950, a circulation induced by chemical reactions was known to persons skilled in the art, or at least taught by the prior art. Neither the Schwarz nor the Miles patent teaches a circulation or agitation of the bath produced by chemical reactions or the direction of any circulation of the bath. Indeed, the concept of reaction-induced circulation would not necessarily be recognized by persons skilled in the art even today, for it is not clearly taught by the specification of the patent in suit and there was disagreement in the expert testimony at trial as to its existence. In any event, if reaction-induced circulation were not known to persons skilled in the art at least in 1950, the concept of material agitation by the oxygen stream which would overcome such circulation would also have been unknown to such persons.

In addition, persons skilled in the art who testified for plaintiffs did not seem to know what the language of the [119] claims referring to material agitation meant or to be able to tell when the conditions of such agitation or its avoidance would exist. For example, when Dr.

Hauttmann, one of the patentees, was asked: "How would an operator practicing oxygen blowing tell when the agitation produced by the jet became material?", he answered: "I do not know that." (R. 2414.) When Mr. Prince, a metallurgical engineer employed by plaintiff Kaiser, was asked: "When does agitation become material?", he finally replied: "I don't know, Mr. Groner. It is just when agitation becomes material." (R. 5784.) Also, when Dr. Chipman was asked: "You don't know from anything in the patent when a harmless agitation becomes a material agitation, do you, Doctor?", he replied: "I don't think so." (R. 880.)

Thus this Court concludes that the claim step of avoidance of material agitation of the bath by the oxygen stream is not supported by the specification of the patent in suit except in a very limited and perhaps meaningless way, and could not have been a meaningful concept to persons skilled in the art at the time the invention was made, especially since the concept did not appear very meaningful to some of plaintiffs' expert witnesses even at the trial roughly fourteen years later.

This Court is further persuaded on the basis of plaintiffs' own testimony that the concept of material agitation of the bath by the oxygen stream is purely fictional, since plaintiffs' own testimony strongly suggests that materal agitation by the jet could not be achieved even with deep penetration. Dr. Ascher H. Shapiro, a professor of Mechanical Engineering at Massachusetts Institute of Technology, a witness for plaintiffs, [120] testified that the force of chemical reactions which would tend to create a downward circulation in the center of the bath would be roughly 3,000 times

stronger than the force of the jet blowing vertically from above (R. 3772-73; PX 267), and that the "power" of such reactions would be more than 8,000 times stronger than that of the jet. (R. 3801; PX 272.) In view of the tremendous force of chemical reactions agitating the bath and initiating a circulation downward in the center of the bath as compared with the relatively feeble agitating power of the jet, it seems impossible that a deep penetration by the jet could overcome or even materially affect such circulation, so as to cause a material agitation by the oxygen stream.

Dr. Shapiro's testimony was confirmed, in effect, by Dr. Elliott (R. 6280), and also Dr. Chipman, who apparently concluded that there could be no such thing as material agitation of the bath by the oxygen stream when making steel by an oxygen top blowing process. Specifically Dr. Chipman testified:

> "The teaching that I find in the patent wth respect to agitation leads me to conclude and understand that the agitation which is present in actuality is far greater than the agitation by the oxygen stream, compared to which the agitaton of the oxygen stream becomes immaterial." (R. 880.)

Also, when he was asked:

> "If a manufacturer, a steel maker, came to you as an expert and asked you how much agitation he would have produced by the oxygen stream and still stay outside the patent, what would you advise him?"

Dr. Chipman replied:

> ". . . I would say, however, that he would not be able to get oxidation by the oxygen stream—agita-

> tion by the oxygen stream. He would not get agitation by the oxygen stream of the molten metal. . . . He would never see the agitation that he [121] gets. He would never know that the oxygen stream was doing any agitating, because there are so much more active forces— . . . agitating . . ." (interrupted). (R. 880-81.)

Dr. Chipman defined material agitation negatively as follows:

> "If there are other sources of agitation which overshadow the agitation of the simple action of the gas on the metal, then I think you do not have material agitation." (R. 889.)

He continued to speak of agitation by the oxygen stream, stating:

> "You know that by comparison with other phenomena, it is very small." (R. 900. See also R. 879, 886-87, 1065-66.)

Significantly, plaintiffs admit that there is no evidence in the record that deep penetration would, in fact, cause material agitation. On final arguments, the following discussion occurred:

> "*The Court*: Then if there is in fact the deep penetration, like under Schwarz and Miles, or, as you claim, under Durrer and Hellbruegge—if there is in fact deep penetration, does the agitation of the bath caused by deep penetration overcome the circulation caused by the chemical reactions?
>
> "*[Counsel for Plaintiffs]*: I don't know whether that would be the exact case when you are blowing under those circumstances—that is, blowing very deeply into the bath. I don't know whether the me-

chanical action would be supreme or what the effect would be. I don't believe it's covered by the evidence." (R. 13,332-33.)

Likewise, Dr. Chipman testified that he did not know whether, in fact, deep penetraton would cause agitation of the bath. (R. 949-51.) And Dr. Hauttmann testified that he had had no experience regarding deep blowing from above. (R. 2519.)

There is, moreover, tangible evidence in the record tending to confirm that the concept of material agitation by the oxygen stream is a fiction. During the trial of this litigation, defendant's witnesses conducted an oxygen steelmaking demonstration (No. 7) in the presence of this Court in the Cast Metal [122] Laboratories of the University of Michigan at Ann Arbor. Demonstration No. 7 involved a deep penetration of the metal bath by the oxygen jet, as established by damage to the refractory bottom visible after the heat was concluded and the converter was emptied of molten metal. Portions of the demonstration were recorded in a movie (DX 162D) viewed by the Court both during and after the trial. During the major part of the blow as shown in the movie, large amounts of slag and metal were thrown up and out of the converter onto the floor, indicating a violent agitation of the metal bath. However, during the last few seconds of the blow when the chemical reactions in the bath had subsided, there was no throw-out whatever, although the blowing pressure of the oxygen jet, according to a gauge visible in the movie, remained at forty pounds per square inch, at which pressure considerable throw-out of metal and slag had previously occurred. In other words, the agitation of the bath as shown by the throw-out subsided near the

end of the blow, although the action of the oxygen jet remained constant. If the bath agitation causing such throw-out of metal and slag had been caused by the mechanical action of the oxygen stream alone, the throw-out would not have ceased as it did near the end of the blow. It is obvious, therefore, that the action of the oxygen stream alone was not responsible for the agitation of the bath causing throw-out of metal and slag during the major part of the blow. Plaintiffs rely heavily on such quieting of the bath at the end of the blow in defendant McLouth's steelmaking operations as evidence that McLouth avoids "material agitation of the bath by the oxygen stream". Applying plaintiffs' own argument, "material agitation of the bath by the oxygen stream" was also avoided in demonstration No. 7 despite deep [123] penetration of the bath by the oxygen jet. But if material agitation by the oxygen stream is avoided even with deep penetration, then the concept of material agitation by the oxygen stream is clearly a fiction, since such agitation is apparently always avoided when blowing vertically, regardless of the depth of penetration.[8] Demonstration No. 7 illustrates that

8. It should be noted that in another of defendant's demonstrations to the Court in Ann Arbor, Michigan, No. 5, no refractory damage occurred and good steel was made without an afterblow, which suggested an avoidance of deep penetration within the meaning of the specification of the patent in suit. In demonstration No. 5, as well as in demonstration No. 7, the bath quieted down at the end of the blow, as shown by the disappearance of throw-out in the movie (DX 160D) recording portions of the demonstration. Thus, applying plaintiffs' argument, material agitation of the bath by the oxygen stream was avoided in demonstrations involving both deep and non-deep penetration of the bath by the jet.

even with deep penetration of the bath by the jet, such agitation of the bath as may occur results from chemical reactions rather than the mechanical action of the oxygen jet upon the bath. But if deep penetration as well as non-deep penetration fails to bring about an agitation of the bath by the oxygen stream, as in demonstration No. 7, then there can be no logical correlation between the avoidance of deep penetration and the avoidance of material agitation of the bath by the oxygen stream. It follows that the teaching of the specification to avoid deep penetration does not provide support for the language in the claims of the patent in suit "to avoid material agitation of the bath by the oxygen stream."

Dr. Elliott was the witness at trial upon whom plaintiffs primarily relied to establish support for the claim step of avoidance of material agitation by the jet. He defined the avoidance of material agitation by reference to the formation [124] of an early fluid slag during the blow, production of steel low in phosphorus, and the avoidance of refractory damage. (R. 6167.) Dr. Elliott similarly defined avoidance of deep penetration with reference to the same three factors. (R. 6169.) Thus his definitions apparently represent an attempt to equate material agitation with deep penetration. However, as already noted, the specification of the patent in suit does not teach any such correlation between the two concepts, and in fact the doctrine of file wrapper estoppel prohibits any such construction of the claim, since claims previously submitted expressly referring to the avoidance of deep penetration were rejected and then cancelled by the applicants. (PX 2A.) Moreover, demonstration No. 7, along with other evidence already dis-

cussed, established a lack of any correlation between the two concepts in fact, since such evidence indicates that material agitation by the jet will be avoided even with deep penetration by the jet. Dr. Elliott himself relied on the quieting of the bath at the end of the blow as in demonstration No. 7 as a sign of avoidance of material agitation of the bath by the oxygen stream. (R. 6278-79.)

Even assuming that the Court could accept Dr. Elliott's equation of material agitation with deep penetration, the meaning of material agitation would still not be adequately clarified, since even the concept of deep penetration does not acquire a clear or consistent meaning from Dr. Elliott's testimony. For example, he testified that deep penetration causes an up in the center circulation, which may cause refractory wear on the walls near the bath surface. (R. 6146-56; PX 349.) However, he later testified that deep penetration causes bottom damage to the refractory (R. 6166) as the result of a downward moving stream of [125] hot metal in the center of the bath. (R. 12,340-43, 12,363.) Clearly, circulation cannot be both up and down in the center at the same time.

In addition, Dr. Elliott gave inconsistent definitions of deep penetration, as illustrated by defendant's demonstration No. 9 to the Court in May, 1964, at Ann Arbor Michigan. In demonstration No. 9, a hole was burned through the bottom of the refractory, permitting the molten metal in the converter to run out into a pan beneath the converter. (See movie, DX 164D.) Dr. Elliott defined deep penetration by reference to such bottom damage (R. 6168-69), testifying also that "deep pene

tration arises when the jet enters more than, say, 35 to 40 per cent of the bath depth." (R. 6637.) From this testimony it seems that Dr. Elliott would have regarded the penetration in demonstration No. 9 as being at least 35 to 40 per cent of the bath depth. Yet he later testified that the penetration of the jet in demonstration No. 9 was no more than 1.5 inches of a 6.8 inch bath depth, or approximately 22 per cent of the bath depth (R. 12,382, 12,610), using Dr. Shapiro's correction factor of 0.233 to arrive at his estimate. (PX 231, 232.) Such contradictions appear to weaken Dr. Elliott's testimony with respect to the meaning of avoidance of material agitation by the oxygen stream.

Finally, the language in the claims concerning the avoidance of material agitation of the bath by the oxygen stream, although relied on by plaintiffs as a characteristic of the claims essential to novelty, appears under plaintiffs' own definition of the phrase to be mere surplusage in the claims. Plaintiffs take the position that material agitation by the jet is avoided unless [126] a down in center circulation induced by chemical reactions is overcome by the force of the jet. (E.g. main brief, pp. 191-94; R. 13,331-32.) But if such material agitation is avoided whenever a reaction-induced circulation is not overcome by the mechanical action of the jet, then the reference in the claims to the existence of a circulation induced by chemical reactions is the only language in the claims necessary to express the idea, and the language referring to the avoidance of material agitation by the jet is merely extraneous.

As previously stated, it appears to this Court that the real reason for the inclusion of language in the

claims of the patent in suit concerning the avoidance of material agitation by the jet was the desire by the applicants to distinguish the prior art Miles patent, which expressly taught that the jet itself agitated the bath. In effect, the specification of the patent in suit presented a new theory of agitation caused by chemical reactions, and the claims referred to an avoidance of agitation by the jet to give the impression of an entirely new steelmaking process. However, if material agitation by the oxygen stream is a fiction, as defendant's demonstration No. 7 and other evidence strongly suggest, then even under the process as taught by Schwarz and Miles, chemical reactions rather than the mechanical action of the jet must have been the actual cause of agitation in the bath. At least plaintiffs have failed to prove otherwise. And if the language of the claims of the patent in suit referring to the avoidance of material agitation covers the actual practice of steelmaking under the Schwarz and Miles patents, then plaintiffs can hardly rely on such language of the claims as a characteristic of the process essential to novelty. In other words, if Schwarz [127] and Miles avoided material agitation of the bath by the oxygen stream even with deep blowing, then such avoidance of material agitation by the oxygen stream cannot be considered a significant feature of the claims of the patent in suit.

(b) *Chemical reactions "producing a circulatory movement in the molten metal"*

The claim of a circulatory movement in the molten metal produced by chemical reactions in a localized reaction zone is simply not supported by the teachings of the specification of the patent in suit. References relied on by plaintiffs in this connection do not teach a circulation induced by chemical reactions. Col. 4, lines 26-38, teach, on the contrary, that

> "application of the oxygen jet substantially vertically or approximately vertically upon the central portion of the bath surface brings about a flow in the molten metal from the center of the surface of the bath downwardly and then along the bottom of the refining vessel, and upwardly at the sides of the vessel to the surface of the bath, so that portions of the unrefined metal are continuously presented to a localized center of direct oxygen reaction with the bath metal, while reacted or oxidized portions of the bath move away from this reaction center."

This language clearly refers to a circulation brought about by the application of the jet upon the bath surface. Chemical reactions are not mentioned in this reference as a factor in creating circulation, as Dr. Hauttmann, one of the patentees, admitted (R. 2515.)

Col. 4, lines 43-67, also relied on by plaintiffs, teach that

> "initial contact of the high purity oxygen jet with the molten metal bath causes a rapid combination of oxygen and iron to form FeO in the confined central reaction zone . . . [and that] A portion of

> the iron oxide goes to the slag with the other oxidized elements and a portion diffuses into the bath under the influence of the [128] bath circulation, so that within the first three minutes of the blowing vigorous carbon combustion is initiated due to the high temperatures developed by these reactions. The ensuing reaction of carbon with the FeO and directly with the oxygen gas in the confined direct oxidation zone causes rapid formation of carbon monoxide *and the formation of this CO causes a strong boil or agitation of the bath, which augments the bath circulation to continuously present unrefined metal to the oxygen gas reaction zone* and to create a slag-metal emulsion." [Emphasis supplied.]

This reference teaches that carbon monoxide formation causes a strong boil or agitation of the bath within the first three minutes of the blow, which "augments" the bath circulation already in existence brought about by the application of the oxygen jet as taught in col. 4, lines 28-34. The reference teaches that chemical reactions produce only an "agitation of the bath" rather than circulation, and that the agitation thus produced merely "augments" circulation already in existence.

Col. 6, lines 62-72, also relied on by plaintiffs, state:

> "The vigorous boil, above mentioned, continues up to the carbon end point, and together with the induced circulation of the bath metal toward and away from the central zone of direct oxygen reaction, effectively counteracts any tendency to over-oxidation of the bath. When the flame dies and carbon combustion is completed, the bath becomes

relatively quiet and intimate contact between slag and metal bath ceases. The turbulence of the bath and slag due to the oxygen stream impinging from directly above is insufficient to cause continuance of oxygen-metal reactions."

This reference does *not* teach that when chemical reactions cease, circulation of the bath also ceases. Thus no casual connection is made explicit in this reference between chemical reactions and circulation. The reference does refer to "the induced circulation of the bath metal toward and away from the central zone of direct oxygen reaction." However, this language clearly refers back to the teaching of col. 4, lines [129] 28-34, of a circulation induced by the application of the jet to the bath surface. Such language cannot be read as teaching a circulation "induced" by chemical reactions, in light of the clear teaching of col. 4, lines 63-67, that chemical reactions cause only "a strong boil or agitation of the bath." The sentence at col. 6, lines 62-66, that mentions the "induced circulation" also refers to a "vigorous boil, above mentioned," which clearly refers back to the teaching of col. 4, lines 63-67, of a boil caused by chemical reactions that merely augments the pre-existing circulation brought about by the mechanical action of the jet.

Thus, none of the references in the specification relied on by plaintiffs teaches in so many words that circulation of the bath is produced by chemical reactions as claimed. The specification teaches a circulation brought about by the jet and merely augmented by a strong boil or agitation of the bath resulting from subsequent chemical reactions.

Plaintiffs also rely on a reference in the specification of the original patent application of Dr. Suess (PX 2B) to support the claim of reaction-induced circulation. This reference states:

> "In carrying out the present process as a refining treatment of iron with oxygen, upon blowing oxygen to the surface of molten iron, gas formation takes place by local reaction between the oxygen and the carbon present in the iron, and this gas formation causes strong movement in the molten bath. The reaction gases exert pressure in downward direction, because their escape in upward direction is checked by the pressure of oxygen and the presence of slag. Thus, a movement of the molten material in the direction of the gas stream results. The stream of molten material turns by 90° when reaching the bottom of the reaction vessel and moves finally in upward direction along the walls of the vessel." (PX 2B, pp. 3-4.)

[130] There is no such teaching in the specification of the continuation-in-part application which finally became the specification of the patent in suit and, therefore, the teaching of the original specification relied upon by plaintiffs must be considered as abandoned in the continuation-in-part application. In any event, there is no need to look beyond the specification of the patent itself because it is not ambiguous on this point. Incidentally, the reference in the original specification recites a theory of circulation inconsistent with the theory of circulation advanced by plaintiffs' expert witnesses at trial and is, therefore, not a teaching upon which plaintiffs would wish to rely very strongly.

Plaintiffs contend that the claim of reaction-induced circulation is supported by the teaching of the specification at col. 4, lines 32-34, of a circulation down in the center, which admittedly could only be caused by chemical reactions. (E.g., defendant's main brief, p. 52.) However, even though there may have been no dispute at trial that a down in the center circulation could only be brought about by chemical reactions, such is not the teaching of the specification. Col. 4, lines 26-38, already quoted, teach that a down in center circulation is brought about by the application of the oxygen jet and no mention is made of chemical reactions as a factor in initiating circulation.

Moreover, the teaching of a down in center circulation does not provide adequate support for the claim of a circulation induced by chemical reactions because the claim is not limited to any particular direction of circulation. Indeed, plaintiffs rely on the fact that the claim mentions no direction of circulation to justify a finding of infringement even if the Court [131] should find that the circulation in defendant's operations is a reaction-induced circulation up in the center. For example, at p. 385 of plaintiffs' main brief, it is stated:

> "McLouth does not dispute the fact that it obtains a circulatory movement in the bath in its operations. It does contend that the *direction* of circulation in its operation is the opposite of the direction of circulation taught in the *specification* of the Suess et al. patent (McLouth's Trial Brief, p. 101). However, the patent *claims* do not specify any direction of circulation. They specify merely the cause of the circulatory movement. Thus, even if

> the direction of the circulation is opposite to that set forth in the *specification,* it is of no consequence if the circulation is caused by the chemical reactions as specified in the clams." (Emphasis in original. See also R. 13,287.)

If the specification teaches only a down in center circulation, then the claim, which is not limited to any direction of circulation, would clearly overclaim the specification. As already noted, the Supreme Court in *Schriber-Schroth Co. v. Cleveland Trust Co.,* 305 U. S. 47, 57 (1938) stated:

> ". . . the patent monopoly . . . cannot be enlarged by claims in the patent not supported by the description . . ."

If plaintiffs were to argue in response to such conclusion that the claim is actually limited to a circulation down in the center because a reaction induced circulation can be *only* down in the center, such an assertion is certainly not taught by the specification, nor would it necessarily be known to persons skilled in the art even today. For example, the Cuscoleca patent, No. 2,803,534, which was issued August 20, 1957, teaches a circulation up in the center as a result of chemical reactions. (DX 68.) Certainly an allegation that circulation of a molten metal bath produced by chemical reactions could only be down in the center would not have been a fact known to persons skilled in the art in [132] 1950, since at that time there was no general knowledge among steelmakers of a reaction-induced circulation. An "explosive bubble" mechanism which would tend to justify a conclusion that reaction-induced circulation in a molten metal bath could only be down in the center was

advanced by Dr. Chipman and Dr. Shapiro for the first time at the trial of this litigation in 1963 and 1964 (R. 480-82, 490-92, 496-500, 3693-98), and was admittedly not contained in any literature prior to the time of trial. (R. 4250-51.)

In sum, plaintiffs are forced to engage in tortured construction of the specification and claims in the patent in suit in order to find support in the specification for a claim of reaction-induced circulation. In view of the relative ease with which such a claim could have been supported by even a sentence or two in the specification, this Court is unwilling to overlook plain language of the specification to find support for such claim.

(c) *Blowing "below the surface"*

At least thirteen separate references in the specification of the patent in suit speak of "surface blowing" or "blowing onto the surface," etc. But there is no reference anywhere in the specification to blowing "below the surface," as claimed. Col. 5, lines 61 and 62, speak of "the confined zone of direct oxygen *reaction at the surface* of the molten metal bath," (emphasis is added) which would seem to preclude a claim of blowing below the surface. Plaintiffs find support for the claim of blowing below the surface in the teachings of the specification to avoid deep penetration, and also defendant's admission (R. 854) that from such teachings "there may be implied some penetration." [133] However, the word "below" would seem to cover even a deep penetration of the bath by the oxygen stream, which is certainly not taught by the specification. The ambiguity of the word "below" in the claims would justify the Court in

looking beyond the patent itself to the file wrapper history to help resolve such ambiguity. As the Sixth Circuit Court of Appeals observed in *Bobertz v. General Motors Corporation*, 228 F. 2d 94, 97 (1955), cert. den. 352 U. S. 824 (1956):

> "The claims of a patent are to be interpreted, not only in the light of the specifications, but also with reference to file-wrapper history."

The file wrapper history in this case (PX 2A) indicates that the language "below the surface" was added to the claims for the first time on June 18, 1957, only shortly before the patent was issued, and apparently in response to the rejection of previous claims of blowing "onto the surface" as unpatentable over prior art. Further, counsel for the applicants had previously argued to the Patent Office that the avoidance of deep penetration meant "a practically negligible penetration of the surface of the molten metal by the oxygen jet." (PX 2A, p. 68.) Under such definition, the teaching of avoidance of deep penetration in the specification would support a claim of blowing "below the surface" only to "practically negligible" degree. But even disregarding the file wrapper history, the Court concludes that the teaching in the specification of an avoidance of deep penetration is not adequate support for a broader claim of blowing "below the surface."

[134] (3) THE CLAIMS COVER PRIOR ART

The broad scope of the claims, as compared with the specification of the patent in suit, is demonstrated by the fact that according to plaintiffs' own testimony, the inference can fairly be drawn that even a person

practicing the prior art would infringe the process of the claims.

Blowing "onto and below the surface" is certainly taught by the Schwarz and Miles patents.

As for the avoidance of "material agitation of the bath by the oxygen stream," according to the testimony of Dr. Chipman, such agitation by the jet will always be avoided when blowing vertically because a far more powerful agitation of the bath caused by chemical reactions renders any agitation by the jet insignificant, regardless of the depth of penetration by the jet. For example, when asked:

> ". . . do you think anyone skilled in the art would have any difficulty in blowing in such a way as to avoid material agitation of the bath?"

Dr. Chipman replied:

> "He is going to blow in such a way to generate powerful chemical reactions which do a lot of agitating. He has to do this in order to operate the process. So he wouldn't have a bit of difficulty in setting up conditions where the chemical effects of CO evolution far over-shadow the effects of the direct agitation by the mechanical action of the oxygen stream." (R. 1064-65. See also *supra* II. E. (2) (a).)

As for the "localized reaction zone," Dr. Chipman defined such a zone as "the reaction in which the oxygen stream engages the metal."

The Court then inquired:

"It is anywhere the oxygen stream may engage the metal bath. Is that what you are saying?

[135] "A. Yes, your Honor." (R. 909.)

Dr. Chipman also testified that the localized reaction zone is a characteristic of the process which could not be avoided, even by blowing according to the teachings of Schwarz and Miles. Thus, at R. 1018, he was asked:

"Doctor, you have just admitted that if you blew according to Miles or according to Schwarz, so that you had penetration, you would have the hot spot in the cavity. That is correct, isn't it?

"A. Yes."

Also at R. 906-07, the following discussion occurred:

"Q. Well, do you mean that any time you jet oxygen onto a bath, you have in that fact alone answered this step of the claim?

"A. If a reaction occurs in the zone, yes.

* * *

"Q. I am trying to find out where the extent of the reaction zone is. Once more, suppose I am the manufacturer who wants to avoid this patent and I can avoid it by avoiding the localized reaction zone. Now, what do I do?

"A. You use another process.

"The Court. Use what?

"A. Another process. The localized zone is a characteristic of the process, and he cannot avoid it."

With regard to "high temperature," Dr. Chipman testified as follows:

"Q. . . . Now, do I understand from this that the hot spot develops at the bottom of the cavity made by the penetrating jet?

"A. All over the cavity.

"Q. And that occurs without regard to the depth of the cavity?

"A. Yes. The hot spot develops all over the cavity without regard to the depth.

[136] "Q. I take it that the hot spot you speak of there develops all over the cavity when you practice the teaching of Schwarz; is that so, Doctor?

"A. I think so.

"Q. You can't avoid it, can you?

"A. I don't think you can avoid it.

"Q. And it happens when you practice the teaching of Miles?

"A. Blowing oxygen onto and into the bath, you can't avoid the high temperatures." (R. 1016-17.)

With regard to the claim of a reaction-induced circulation, it is undisputed by the parties that a circulation of the molten metal bath down in the center could only be caused by chemical reactions and not the mechanical action of the jet. (E.g., defendant's main brief, p. 52.) Both Dr. Chipman and Dr. Elliott testified for plaintiffs that bottom damage in certain of defendant's tests involving deep penetration by the jet was caused by a downward moving stream of hot metal. (R. 635-36, 12,340-43.) However, if a steelmaker practicing

even deep penetration as taught by Schwarz and Miles has a down in center circulation which may result in bottom damage, then such a steelmaker must have a reaction-induced circulation as claimed by the patent in suit, even though he is practicing the prior art. Additionally, the testimony of plaintiffs' witnesses with respect to the tremendous force of chemical reactions creating a circulation down in the center would tend to suggest that even deep penetration as taught by the prior art would result in such down in center circulation. (E.g., R. 3772-73; PX 267; R. 3801; PX 272.)

[137] Dr. Hauttmann, one of the patentees testified that he had no actual experience regarding deep blowing from above (R. 2519, 2522), and that he merely assumed that the circulatory movement of the bath as taught by the prior art was up in the center. (R. 2524.) He finally admitted that he did not know the actual direction of circulation under prior teachings or whether it was in fact the same circulation as produced by the method of the patent in suit, stating: "We have no data on that." (R. 2772.) It would seem, therefore, that the distinction between the claims of the patent in suit and the prior art practice may well be a purely verbal one. In this connection, it must be noted that plaintiffs had considerable opportunity, both before and during the trial of this suit, to conduct steelmaking experiments that would illustrate a distinction, if any, between the process as claimed in the patent in suit and the practice of steelmaking under the Schwarz and Miles teachings of deep penetration. However, plaintiffs admittedly failed to come forward with evidence of any such experiments. (R. 13,332-33.)

(4) CONCLUSION ON CLAIMS UNDER § 112

In sum, it appears to this Court that when the applicants were faced with the rejection of claims accurately stating what they regarded to be their invention as unpatentable over the prior art, they unwisely abandoned such claims and instead substituted new claims which were accepted by the Patent Office. The new claims failed to point out the actual invention of the patentees, and, in addition, certain portions of the claims were not given adequate or meaningful support by the specification. At trial, certain of plaintiffs' witnesses candidly interpreted the claims of the patent in suit as being so broad that any [138] commercial steelmaking operation involving vertical blowing would necessarily infringe even if the operation were following prior art teachings, although the language of the new claims was clearly intended to distinguish the prior art patents. Such claims, if allowed, would flout the patent law of the United States.

It is well-settled that valid patent claims cannot claim more than the actual invention of the applicant. *Lincoln Engineering Co. v Stewart-Warner Corp.*, 303 U. S. 545, 549 (1938); *Holstensson v. V-M Corp.*, 325 F. 2d 109, 122 (CA 6, 1963); *Plax Corp. v. Precision Extruders*, 239 F. 2d 792, 795 (CA 3, 1957). As Mr. Justice Story stated as early as 1822 in *Evans v. Eaton*, 20 U. S. 356, 430:

> ". . . it is clear that the party cannot entitle himself to a patent for more than his own invention; and if his patent includes things before known, or before in use, as his invention, he is not entitled to

recover, for his patent is broader than his invention."

It is equally well-settled that valid patent claims cannot claim more than the specification discloses. *Schriber-Schroth Co. v. Cleveland Trust Co., supra,* 305 U. S. 47, 57 (1938); *Application of Holmen,* 347 F. 2d 852, 855 (C.C.P.A. 1965); *Del Francia v. Stanthony Corp.,* 278 F. 2d 745, 747 (CA 9, 1960); *Texas Co. v. Globe Oil & Refining Co.,* 225 F. 2d 725, 735 (CA 7, 1955).

Moreover, it is well-recognized that claims are too broad when they cover the prior art and are not confined to an applicant's advance in the art. *United Carbon Co. v. Binney & Smith Co.,* 317 U. S. 228, 236 (1942); *Huntman Stabilizer Corp. v. General Motors Corp.,* 144 F. 2d 963, 967 (CCA 3, 1944); *In re Oakes,* 140 F. 2d 669, 671 (C.C.P.A. 1944); *Heyer v. Brenner,* [139] 242 F. Supp. 538, 540 (D.C. Dist. of Col., 1965). As Mr. Justice Jackson stated in the *United Carbon Co.* case, *supra,* at 236-37:

> "The statutory requirement of particularity and distinctness in claims is met only when they clearly distinguish what is claimed from what went before in the art and clearly circumscribe what is foreclosed from future enterprise. . . . An invention must be capable of accurate definition, and it must be accurately defined, to be patentable."

In this connection, the Supreme Court commented in *Merrill v. Yeomans,* 94 U. S. 568, 574 (1876):

> "It seems to us that nothing can be more just and fair both to the patentee and to the public, than

> that the former should understand and correctly describe just what he has invented, and for what he claims a patent."

Further, the Supreme Court stated in *General Electric Co. v. Wabash Appliance Corp.*, 304 U. S. 364, 369 (1938):

> "The limits of a patent must be known for the protection of the patentee, the encouragement of the inventive genius of others and the assurance that the subject of the patent will be dedicated ultimately to the public. The statute seeks to guard against unreasonable advantages to the patentee and disadvantages to others arising from uncertainty as to their rights. The inventor must 'inform the public during the life of the patent of the limits of the monopoly asserted, so that it may be known which features may be safely used or manufactured without a license and which may not.' The claims 'measure the invention.' "

The claims of the patent in suit do not measure the invention of the applicants; they do not accurately define or correctly describe just what the applicants invented; they do not find adequate support in the specification; and they do not clearly distinguish what is claimed from what went before in the art. Therefore, the claims do not meet the requrements of 35 U.S.C. § 112, and the patent in suit must be held invalid. 35 U.S.C. §282(3).

[140] III. CONCLUSION

The Court reaches its conclusion that the patent in suit is invalid reluctantly, not only because of the statutory presumption of validity but also because of the revolutionary nature of the invention disclosed in the specification. Revolutionary patents such as this one are entitled to a liberal construction. *Eibel Process Co. v. Minnesota & Ontario Paper Co.*, 261 U. S. 45, 63 (1923); *Cold Metal Process Co. v. Republic Steel Corp.*, 233 F. 2d 828, 837 (CA 6, 1956). However, even under a liberal construction of the patent in suit, the failure of the claims to focus on or limit themselves to the precise advance in the art by the patentees renders the patent invalid. Certain elements of the claims are simply not adequately supported by the specification to justify the granting of a patent monopoly in the broad language used. Morover, the claims take away from steelmakers the right to operate under certain prior art teachings if they choose.

It is not too much to require that the scope of patent monopolies be precisely defined and confined to the actual invention disclosed by the specification. Article 1, Section 8, of the United States Constitution gives Congress the power to secure to inventors the exclusive right to their actual discoveries, and no more. To grant an inventor a monopoly broader than the scope of his actual invention, even though that invention be revolutionary and fully disclosed in the specification of his patent, is not permitted by the Constitution or patent legislation as interpreted by the courts. *Holstensson v. V-M Corp., supra*, 325 F. 2d 109, 125 (CA 6, 1963).

Again it must be emphasized that it was not inevitable that such an outstanding invention as the oxygen steelmaking [141] process at Linz, Austria, should become the subject matter of an invalid patent in the United States. It is not the responsibility of the courts to remedy deficiencies in patent claims which might have been avoided by a more careful preparation and presentation to the Patent Office. Even liberal construction of patent claims does not extend so far.

In this Court's opinion, the Suess et al. patent in suit, No. 2,800,631, is invalid under 35 U.S.C. § 112 for failure of the claims to particularly point out and distinctly claim the subject matter which the applicants regarded as their invention. A judgment must, therefore, be entered for defendant, without, however, the allowance of attorney fees as requested under 35 U.S.C. § 285, which reads: "The court in exceptional cases may award reasonable attorney fees to the prevailing party." A case is not "exceptional" within the meaning of this provision unless the conduct of the party against whom attorney fees are sought may be characterized as unfair or vexatious, or involves bad faith or some other equitable consideration which makes it unjust that the prevailing party should be left to bear the burden of its own attorney fees. *Plymouth Rubber Co. v. Minnesota Mining & Mfg. Co.*, 203 F. Supp. 595 (D.C. Mass. 1962), aff'd, modified on other grounds, 321 F. 2d 151 (CA 1, 1963), cert. den. 375 U. S. 969 (1964); *Hyster Co. v. Hunt Foods, Inc.*, 263 F. 2d 130 (CA 7, 1959); *Rohr Aircraft Corp. v. Rubber Teck, Inc.*, 266 F. 2d 613 (CA 9, 1959). No such characterization of plaintiffs' conduct is even remotely justified.

[140] III. CONCLUSION

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Of course this Court has considered all the issues raised by the parties in this litigation including the issues of infringement and misuse, and the Court has reached its conclusions [142] with respect to all issues in the case only after an intensive review of the entire record. A detailed study of the pertinent evidence was necessary, particularly with respect to the issue of infringement, because of the relevance of such a study to the question of validity as well. However, in view of the Court's holding of invalidity, it becomes unnecessary at this time to discuss the issues of infringement and misuse, those issues having become moot. *Bobertz v. General Motors Corp., supra,* 228 F. 2d 94, 101 (CA 6, 1955), cert. den. 352 U. S. 824 (1956). Such discussion would only serve to lengthen unduly this already protracted opinion.

The parties are invited to submit further proposed findings of fact consistent with this opinion. An appropriate order may be submitted.

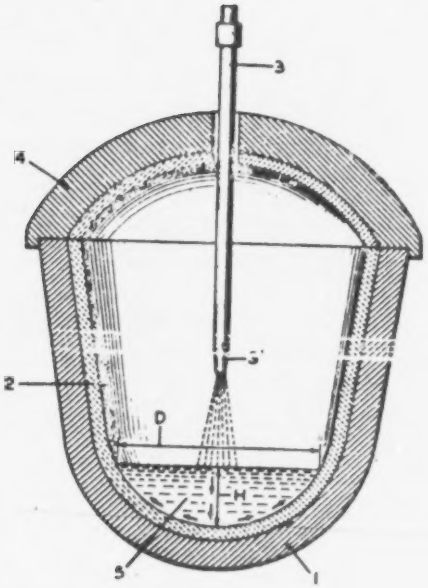
RALPH M. FREEMAN [SGD.]
United States District Judge

DATED: July 6th, 1966.

July 23, 1957 T. E. SUESS ET AL 2,800,631

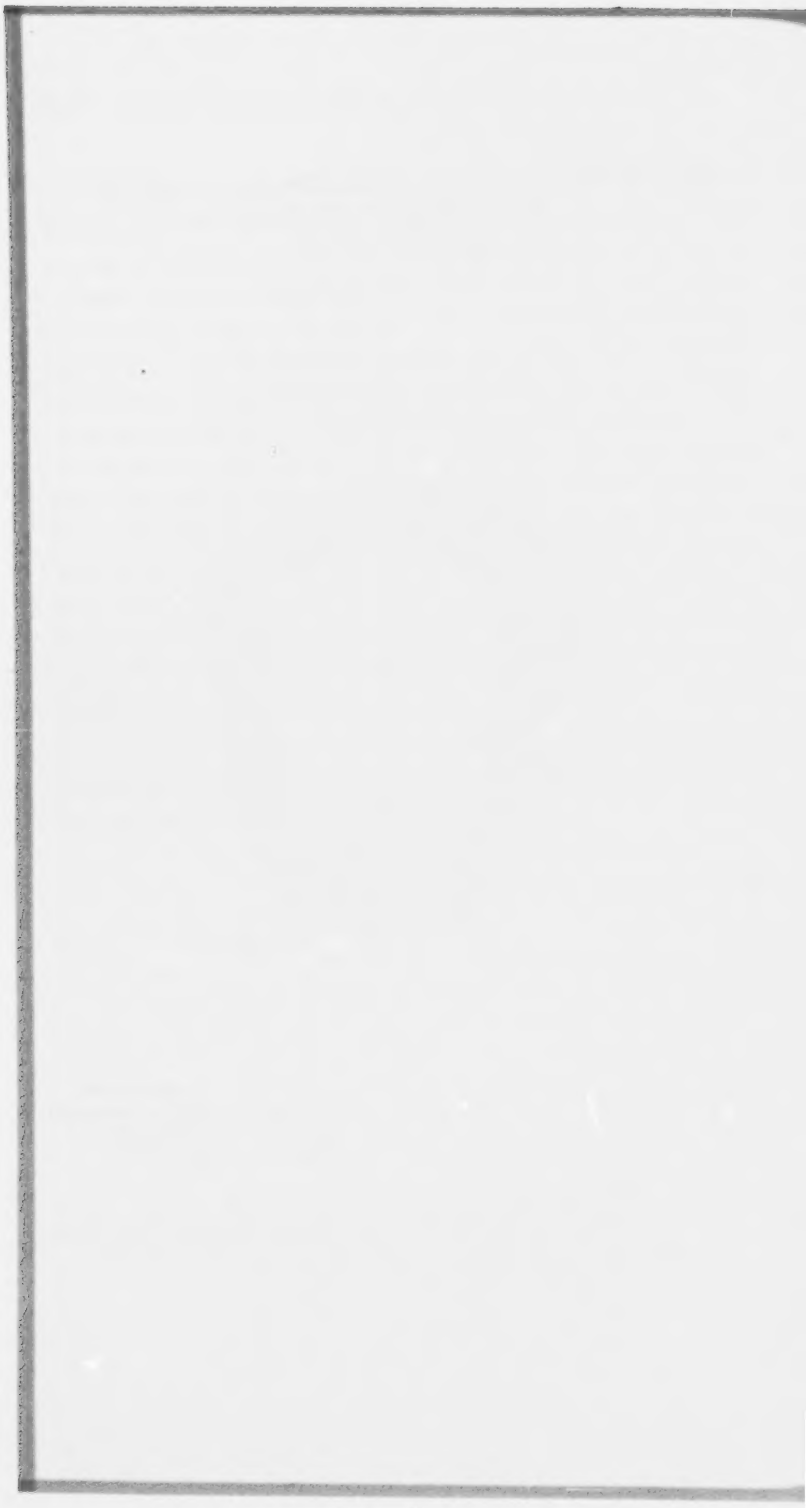
METHOD OF CARRYING OUT MELTING PROCESSES

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INVENTORS
THEODOR E. SUESS, DECEASED
HERBERT TRENKLER
HUBERT HAUTTMANN
RUDOLF RINESCH

BY
Campbell, Burnbaugh, Finch & Hoos
HIS ATTORNEYS



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2,800,631

METHOD OF CARRYING OUT MELTING PROCESSES

Theodor Eduard Suess, Leoben-Donawitz, and Herbert Trenkler, Hubert Hasslmann, and Rudolf Rinesch, Linz (Donaubo), Austria; said Suess assignor to Vereinigte Österreichische Eisen- und Stahlwerke Aktiengesellschaft, Linz (Donaubo), Austria, a corporation of Austria

Application Nov. 16, 1955, Serial No. 547,233

2 Claims. (Cl. 75—60)

This invention relates to a process for the treatment of metallic or metal-containing materials with oxygen-containing gases, preferably high purity oxygen, and has particular relation to a process of this type in which fusible materials are treated at high temperatures with said gases. Still more particularly, the invention relates to a process for the refining of molten metal with high purity oxygen blown downwardly onto the surface of a bath of the molten metal.

The invention is particularly adapted to the refining of primarily hot metal charges, for example, molten pig iron, but it is also applicable to the production of refined metals from solid charges, such as solid pig iron for the production of steel, as hereinafter set forth. The invention is also characterized by the fact that the heat required for the refining of the molten impure metal is autogenous, being produced primarily by reaction of the oxygen gas with the impurities in the molten metal, although when utilizing solid charges of impure metal, the heat required for melting of the charge prior to refining is provided by combustion of a suitable fuel with the oxygen gas.

Processes for the utilization of high purity oxygen in the refining of molten metal charges, such as pig iron, have been suggested ever since the development of the original pneumatic process by Bessemer. Attempts to blow with high purity oxygen in a conventional Bessemer or Thomas converter through bottom tuyeres has resulted in the destruction of the refractory bottom within the short time of one heat. On the other hand, high purity oxygen refining processes have been previously proposed in which the oxygen is directed onto the molten metal bath surface in the form of a jet or jets issuing from tuyeres positioned in the wall of the refining vessel above the melt line. In such processes, the horizontal velocity component of the oxygen jet at the melt surface causes the development of excessively high temperatures above and at the melt-slag interface on the side of the vessel opposite the tuyeres or oxygen jet inlet so that a rapid deterioration of refractory occurs. In addition, with such an inclined oxygen jet, a loss of oxygen efficiency results due to deflection of the gas from the melt surface and burning of a large proportion (40–50%) of the evolved carbon monoxide to carbon dioxide above the melt, which is further undesirable in contributing to the short refractory life. In addition, the heat produced by high purity oxygen-molten metal reactions is more than sufficient to provide the heat necessary for completion of the refining reactions to the desired steel analysis, and this large amount of additional heat developed within the refining vessel due to carbon monoxide combustion is undesirable. Further, in the utilization of high purity oxygen as the refining medium, the reduction in oxygen efficiency resulting from this combustion of the carbon monoxide with a portion of the oxygen feed cannot be tolerated.

Accordingly, it is recognized that the application of such processes, in which the molten materials, for example pig iron, are treated in refining devices provided

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with refractory linings are severely limited due to the extremely high temperatures developed by reaction of the high purity oxygen gas with the molten metal and the short life of the refractory linings when exposed to such temperatures. This is particularly true in those processes, such as production of steel, in which chemical reactions capable of causing corrosion of the refractory lining take place. Thus, in a device provided with refractory lining, such as a converter in the previously proposed processes when high purity oxygen is blown to the surface of a bath of molten pig iron, with or without a slag cover, combustion of the impurities in the metal, and also iron itself result in such extremely high temperatures that the refractory lining is attacked and damaged to such extent that it must be renewed after a short period of use. The refractory materials known at present are unable to resist attacks and stresses of this kind unless the lining is protected by the application of particular conditions from direct exposure to the strong heat developed by the high purity oxygen-molten metal reactions. Accordingly, although the advantages of molten metal refining with high purity oxygen have been recognized, particularly with respect to the reduced nitrogen ballast compared to the air blown pneumatic refining processes, there remains no economical, commercially feasible process for refining of molten metal with high purity oxygen capable of providing long refractory life and high oxygen efficiency. In particular, the deficiencies of the proposed processes, emphasize the lack of a high purity oxygen refining process for molten pig iron having the aforementioned advantages to provide an economical, commercially feasible process for production of refined steel at least equal in quality to that produced by the well known basic open-hearth process from pig iron of widely varying chemical compositions.

It is accordingly one of the main objects of the present invention to provide a process for refining molten metals by surface blowing with high purity oxygen, in which, owing to the particular conditions employed, the refractory walls of the apparatus utilized in carrying out the process are protected from undue corrosion by the excessively high temperatures developed and the chemical reactions taking place at such temperatures.

Another object of the present invention is to carry out the treatment of molten metals, and other molten materials by surface blowing with high purity oxygen in such a manner that the reactions of the oxygen gas with the constituents of the molten bath and the resulting high temperatures, to the extent possible, are limited to an oxygen jet impingement area removed from the refactory lining of the reaction vessel.

It is also a primary purpose and object of this invention to provide a process for the refining of primarily hot metal charges, that is, predominantly molten pig iron, with high purity oxygen gas in which controlled refining at substantially theoretical oxygen efficiency is accomplished.

A further object is to provide a process for refining of molten pig iron with a surface blown high purity oxygen jet in which an exceptionally high refractory life is obtained.

The invention also has as its object to provide a process of surface blowing molten pig iron with high purity oxygen in which the refining reactions and oxygen impingement on the melt surface are controlled in a manner such that over-oxidation of the molten pig iron bath is essentially avoided.

It is still another object of the invention to provide a high purity oxygen refining process which is applicable to pig iron of widely varying chemical compositions including in particular pig iron of analyses used in or

linary basic open-hearth practice, as well as those of higher silicon and phosphorus content required for blowing in the acid Bessemer and basic Thomas converter processes to produce steels having analyses and qualities at least comparable to that of basic open-hearth steels. Another object of the invention is to provide a high purity oxygen refining process for production of steel of excellent quality at a high rate of production, substantially comparable to Bessemer or Thomas converter practice, for example, a blowing time of from 15 to 30 minutes for charges of from 30 to 40 tons to carbon end points of 0.05% or below.

Further objects and advantages of the invention will be apparent from the following detailed description of the process and the appended drawing.

The process of the invention generally comprises refining the molten metal in a converter type or other suitable vessel with a high purity oxygen jet impinging vertically or approximately vertically on the melt surface substantially at the central portion thereof by means of a blast nozzle or other suitable jet producing means under controlled conditions, hereinafter defined, to supply to the molten metal the required amount of oxygen for completion of refining within a predetermined time, and to produce autogenous heat sufficient to insure completion of the refining and adequate temperature in the refined charge for subsequent handling.

It has been found that by suitable arrangement of the nozzle or jet producing device, and operation thereof for the supply and introduction to the molten metal of the high purity oxygen gas, suitable design of the refractory lined refining device in which the process is conducted, and proper use of amounts of materials charged, the foregoing advantages are obtained, including a very efficient protection of the refractory lining.

According to the process of the invention, the high purity oxygen jet is blown vertically, or approximately vertically upon the central portion of the surface of a bath of the molten metal, the jet having a diameter and static pressure at the point of origin, that is, at the blast nozzle or other jet producing means, and the point of origin (blast nozzle) being spaced from the bath surface, such that direct contact of the oxygen jet and the molten metal is established and maintained throughout the refining period without deep penetration of the molten metal bath by the jet. In so operating, the area of jet impingement is controlled to produce a relatively confined zone of direct oxygen to molten metal contact with respect to the total surface area of the bath. It has been determined in application of the present invention to the refining of predominantly molten pig iron charges by means of high purity oxygen, that the jet blown onto the surface of the molten iron, as above described, under a relatively low static pressure at the point of origin, for example, at the overhung blast nozzle, of from 5 to 25 atmospheres (about 75 to 375 pounds per square inch), preferably at about 8 to 12 atmospheres (about 115–175 pounds per square inch), with the jet diameter at the point of origin or blast nozzle being about 1 millimeter (1/25 inch) per ton of charge, and with the point of origin or blast nozzle spaced from the bath surface from at least 150 millimeters (about 6 inches) up to about 3000 millimeters (about 80 inches), produces a sufficiently high reaction velocity of the oxygen with the bath constituents to insure the development of autogenous heat at a rate sufficient to provide the heat required for completion of the refining in a minimum of time, consistent with controlled temperature and control and development of other necessary and required process conditions, such as fluid slag, avoidance of over-oxidation (undue loss of iron to the slag), and avoidance of slopping. The process conducted under these conditions avoids a deep penetration of the oxygen gas into the molten bath which seriously impairs refractory life at the bottom of the refining vessel. In addition, the impingement area of the high purity oxygen on the central portion of the bath isolates the refractory walls of the refining vessel from the extremely high temperatures which are developed by the direct reaction of the oxygen and the molten metal.

It has also been found, according to the invention, that the utilization of suitable design of reaction vessel and the use of the proper amount of material charged results in a ratio of the depth of the bath to the surface area of the bath which augments the protection afforded to the refractory lining of the refining vessel and is also beneficial to the progress of the refining reactions to produce finished steels of low impurity content comparable to those produced by the basic open-hearth process. In carrying out the process of high purity oxygen refining of a molten bath of pig iron, the refining vessel is of such design and the charge is of such amount that the ratio of the depth of the molten bath in meters to the surface area of the molten bath in square meters should be from about 1 to 5 to about 1 to 28 in refining vessels of various design or in terms of the ratio of depth to diameter of a circular bath between 1:2.5 and 1:19. In other metallurgical processes to which the present invention is adapted substantially similar ratios may be used.

Although it is not intended to limit the present invention to any specific theory of action or mechanism, it is believed that application of the oxygen jet substantially vertically or approximately vertically upon the central portion of the bath surface brings about a flow in the molten metal from the center of the surface of the bath downwardly and then along the bottom of the refining vessel, and upwardly at the sides of the vessel to the surface of the bath, so that portions of the unrefined metal are continuously presented to a localized center of direct oxygen reaction with the bath metal, while reacted or oxidized portions of the bath move away from this reaction center. This apparent circulation of the molten material is facilitated by shaping of the bottom of the device in its refractory lining in a uniformly curved design, preferably hemispherical or similar shape, so as to offer the minimum of resistance to the circulation.

Due to the very high affinity of oxygen for iron, initial contact of the high purity oxygen jet with the molten metal bath causes a rapid combination of oxygen and iron to form FeO in the confined central reaction zone. This is demonstrated by ignition of the oxygen and the propagation of a visible flame within the first minute of blowing. This reaction, together with oxidation of impurity elements, such as silicon and manganese, develops extremely high temperatures in the zone of direct oxygen contact with the molten metal which approach the boiling point of iron, as demonstrated by the evolution of a fume consisting iron oxide and manganese oxide. A portion of the iron oxide goes to the slag with the other oxidized elements and a portion diffuses into the bath under the influence of the bath circulation, so that within the first three minutes of the blowing vigorous carbon combustion is initiated due to the high temperatures developed by these reactions. The ensuing reaction of carbon with the FeO and directly with the oxygen gas in the confined direct oxidation zone causes rapid formation of carbon monoxide and the formation of this CO causes a strong boil or agitation of the bath, which augments the bath circulation to continuously present unrefined metal to the oxygen gas reaction zone and to create a slag-metal emulsion. The oxygen jet thus contacts the emulsion of bath and slag components which presents a larger reaction surface and causes the refining reactions to progress rapidly although the oxygen jet does not penetrate deeply into the molten metal bath and is confined to an impingement area at the central portion of the bath surface. This vigorous boiling action is opposed by the pressure of the oxygen jet only in the area of impingement, and outside of this area it represents primarily endothermic

reduction of FeO by carbon to form the evolved carbon monoxide, which reaction thus effectively encompasses the zone of direct oxygen reaction at which the highest temperatures prevail affording a maximum measure of protection to the refractory lining of the refining vessel.

In conducting the process in the manner set forth above, the advantage of exceptionally high refractory life is obtained. For example, in refining of pig iron having the following chemical composition: carbon 3.8–4.2, silicon 0.6–1.3, manganese 1.4–2.2, phosphorus 0.120–0.250, and sulfur 0.045 max., and a slag having the following composition SiO_2 12–17%, CaO 38–44%, MgO 5–10%, MnO 9–13%, P_2O_5 1.2–1.8%, and Fe 12–17%, in a 30 ton converter, the average durability of the refractory is over 200 heats (foregoing in percentages by weight). By comparison, in basic Bessemer practice utilizing air rather than high purity oxygen, the removable converter bottom must be relined after only 35 to 60 heats. In addition, the refractory life obtainable by the process of the invention surpasses that obtained in normally operated open-hearth practice in that in refining of a normal charge by basic open-hearth about 36 lbs. of refractory brick is consumed per ton of steel produced to which must be added some 40 pounds of sintered dolomite for fettling operations, whereas total refractory consumption in the instant process is only about 24 lbs. per ton of steel produced. This advantage is even greater when compared to oxygen lancing in an open-hearth which accelerates refractory consumption.

The further advantage of high oxygen efficiency is obtainable according to the process of the invention when the oxygen jet impinges on the central portion of the molten bath surface from directly above, that is, approximately vertically. Oxygen efficiencies calculated on the basis of total oxygen input compared to oxygen consumed in the bath reactions is approximately 95%. This is demonstrated by an average oxygen consumption of only 57 normal cubic meters (measured at standard conditions of temperature and pressure) per ton of steel including oxygen consumption for heating the converters after relining. This compared with calculated or theoretical oxygen requirements for the refining of the various pig irons known to steel analyses set forth below represents about 95% efficient utilization of oxygen. In addition, analyses of waste gases effluent from the converter indicate that the carbon in the instant process burns almost 100% to carbon monoxide, the analyses showing on the average over 90% CO and less than 10% CO_2, indicating that the oxygen input is not lost by burning with the carbon monoxide above the melt within the refining vessel, as in the case of low angle impingement from tuyeres positioned in the side walls of the refining vessel. Moreover, there is a distinct advantage in the instant process, since the reaction of the oxygen with the melt provides more than sufficient heat for the refining, and additional heat by burning of the carbon monoxide to carbon dioxide above the melt is to be avoided. The potential heat units in the effluent carbon monoxide may be utilized in various ways by subsequent burning.

As above mentioned, it is a characteristic of the process of the invention that in the confined zone of direct oxygen reaction at the surface of the molten metal bath, the oxidation products of the impurities in the pig iron, such as silicon and manganese, as well as the oxidized iron form an early fluid slag which is always very rich in oxides, that is, highly oxidizing. With the formation of the slag-metal emulsion, the iron oxide reacts with the carbon present in the bath, primarily outside of the direct oxygen-metal reaction zone, and since such slag-metal reactions are endothermic, the molten bath is maintained cooler in the vicinity of the walls of the refining vessel or converter. For example in the formation of one kg. of FeO, by direct oxidation with the oxygen jet and absorbed as silicate into the slag, 80 kg. calories of heat are developed. An equal amount of heat is absorbed outside

of the confined central zone of direct oxidation as the FeO (as silicate) is reduced by the carbon in the bath, as one example of slag metal reactions occurring during the blowing.

This formation of an early highly oxidizing fluid slag is of particular value in basic refining when the process is applied to pig iron of analyses used in ordinary open-hearth practice, which would not be amenable to refining by either the acid Bessemer process due to the phosphorus content, or the basic Thomas process due to the lack of sufficient phosphorus. With the rapid heating of the slag cover and metal bath, the proper amounts of lime or lime supplying substance, such as limestone, may be added at the beginning of the blow and during the blow to insure formation and maintenance of a slag of sufficient basicity. Thus, the early fluid, basic and highly oxidizing slag formed provides an accelerated rate of phosphorus and sulfur removal from the bath, leaving the finished steel very low in both elements. With normal open-hearth pig irons having phosphorus contents ranging from about 0.1–0.35%, and even higher, e. g., 0.85% P, and with correct lime additions, final phosphorus contents not higher than about 0.025% and as low as 0.010% are obtained by the time the carbon end point is reached with only a single slagging operation. With sulfur contents in the pig iron of from 0.045 to 0.08%, the sulfur is decreased to 0.02–0.025%, and on the lower range of sulfur in the pig iron to values as low as 0.012%. In usual operations, from 1 to about 4.5% lime is charged to obtain the foregoing result, depending upon the phosphorus content in the pig iron. In addition, all of the lime requirement may be added during initial charging before blowing is started, particularly where the silicon content of the pig iron, which is one of the first oxidized elements, is sufficiently high. On the other hand, the lime may be charged in increments during the blow, but with a sufficient amount initially charged to provide a basicity adequate to absorb the phosphorus.

In the normal range of phosphorus in pig iron of basic open-hearth quality from about 0.1 to 0.35%, the required slag volume including the lime charge is advantageously much lower than the slag volume in the bottom blown basic Thomas process. The iron content of the slag varies from about 9 to 18%, with generally higher FeO content in the slag at higher phosphorus contents in the pig iron, and also at lower manganese contents. Accordingly, the lower percentage of slag, for example, 11 to 12% compared to about 22% in the Thomas process results in comparable or lower total iron content lost to the slag, even though the FeO content of the slag may be higher than the usual 10% in the basic Thomas process.

The process in its preferred embodiment utilizes high purity oxygen, by which the term is meant oxygen gas analyzing at least 97% O_2. For minimum nitrogen content in the finished steel of at least 98% oxygen and preferably 99% or higher should be utilized. The frequency curves based on produced steel analyses indicate that oxygen of at least 98% purity provides a peak or maximum at a nitrogen content of from 0.002 to 0.003%, with 95% of all heats blown showing a nitrogen content of 0.004% or less.

The vigorous boil, above mentioned, continues up to the carbon end point, and together with the induced circulation of the bath metal toward and away from the central zone of direct oxygen reaction, effectively counteracts any tendency to overoxidation of the bath. When the flame dies and carbon combustion is completed, the bath becomes relatively quiet and intimate contact between slag and metal bath ceases. The turbulence of the bath and slag due to the oxygen stream impinging from directly above is insufficient to cause continuance of oxygen-metal reactions. As a result, steels blown by the process of the invention do not suffer from the deteriorating effects of high oxygen (FeO) contents. Direct oxygen determination by the hot extraction method yielded oxygen con-

tents of 0.04% maximum for heats that were blown to a carbon end point of from 0.05 to 0.10% C. Thus, the oxygen content of steels produced by the high purity oxygen blowing process compare very favorably with oxygen contents of basic open-hearth steel in the same carbon range, and are definitely lower in oxygen content than bottom blown Bessemer steels using air, oxygen enriched air, oxygen and steam, or other gas mixture.

As in the basic Bessemer process, the silicon is rapidly eliminated. However, in contrast to the basic Bessemer process, the use of high silicon charges presents no problem due to the fact that slopping is not encountered in the process of the invention to any degree similar to that in the bottom blown Bessemer practice. In fact, higher silicon pig irons actually are advantageous in the high purity oxygen blowing due to the heat producing effect of this element in the early stages of the blow with the result that higher scrap charges can be made in the process.

Regarding scrap additions, the process advantageously may utilize scrap charges of up to about 30%, depending primarily upon the silicon content of the pig iron, and also on the temperature of the hot metal charge. For lower ranges of silicon, such as 0.3 to 0.7% scrap charges of from 10 to 15% are permissible. With silicon in amounts from 1 to 1.2%, scrap charges of 20 to 25% may be utilized.

In general, the manganese content of the fully blown metal and of the slag increases with the total manganese content (pig iron and scrap). However, it is a characteristic of this oxygen steel making process that the high temperatures developed in the reaction zone between the bath metal and the slag cause a reroduction of manganese from the slag into the bath during the latter portion of the refining period. In the last minutes of the blow, the manganese content in the bath again decreases as the carbon drops to its final value, that is, at a normal end point of 0.04–0.06. Accordingly, the manganese content in the finished steel and in the slag is subject to some control, and is governed by slag composition and volume, temperature and final carbon content. With the use of a minimum amount of slag rich in iron oxide, for example only 70 kg. per ton of steel, the amount of loss of manganese to the slag by burning may be considerably reduced. As above mentioned, extensive tests have shown that the amount of slag can be kept considerably lower than the conventional pneumatic process, such as the Bessemer and Thomas processes. Under these conditions of high developed temperature in the refining process and low slag volume with high iron oxide content, a finished steel containing manganese in quantities at least 10 times the amount of carbon, for example, 0.6 to 0.8 Mn at carbon end points of 0.05% are obtainable. Accordingly, it is possible to pour rimming steels down to relatively very low carbon contents without any addition of manganese and deoxidizing agents. Under actual operating conditions the best practice for production of standard grades is to refine down to 0.06–0.08% C and to recarburize in the ladle. This practice results in a manganese content of from 0.6 to 0.8 and eliminates the necessity for manganese additions to conform with the usual analysis specifications. The above manganese content easily compares with the conventional composition of rimming low-carbon open-hearth steels, in fact such analyses are near the upper limit of the range. It is also possible to catch the heat at higher carbon contents, so that the resulting content in manganese will be of a higher order than is normally encountered in rimming open-hearth steels of identical carbon content. Thus, it is possible to produce rimming low carbon high purity oxygen blown steels of a predetermined strength which is based on an inherently higher manganese content of the heat.

It has also been found that a steel containing 0.1% carbon and as high as 1.5% manganese may be obtained, for example by the addition of ordinary blast furnace

ferromanganese, e. g., 15 kg. of 48% blast furnace ferromanganese per ton sufficed, and results in an increase of about 0.05% in the carbon content. In normal steel making operations it was not previously possible to obtain such steels without the use of expensive refined ferromanganese products. Steels of such analyses, not only exhibit increased toughness and yield strength but other properties, such as pressure weldability, are improved.

To exemplify the high manganese recovery in the steel without ferromanganese additions after the blow, the results of the following heats are provided. As indicated above, since the manganese content, under otherwise equal conditions, increases in the finished steel with increase in pig iron, it is to be noted that particularly high manganese content pig irons were employed. Nevertheless, it is evident that due to the extremely high temperatures developed in this high purity oxygen process, a manganese recovery is possible which cannot be reproduced in known processes.

Heat No. 1.—Pig iron analysis: 4.16% C, 3.02% Mn, 0.14% Si, 0.074% P, 0.040% S. Last converter control test (without ferromanganese or deoxidizers): 0.09% C, 0.96% Mn, 0.005% Si, 0.039% P, 0.013% S, 0.007% N_2.

Heat No. 2.—Composition of pig iron: 4.30% C, 3.24% Mn, 0.33% Si, 0.072% P, 0.034% S. Last converter control test (without ferromanganese or deoxidizer): 0.08% C, 1.02% Mn, 0.005% Si, 0.037% P, 0.010% S, 0.004% N_2.

Heat No. 3.—Composition of pig iron: 4.21% C, 2.88% Mn, 0.27% Si, 0.076% P, 0.044% S. Last converter control test (without ferromanganese or deoxidizer): 0.07% C, 0.93% Mn, 0.005% Si, 0.037% P, 0.012% S, 0.004% N_2.

From the foregoing test, it may be seen that manganese recovery at least 10 times as high as the final carbon content in the finished steel is obtainable by the process of the invention utilizing pig iron having manganese on the order of 3%.

In regard to output, the combustion of the impurities of the pig iron and the iron content of the slag total a loss of about 8.0% with an additional 0.8% of iron lost in the dust fume from the process. With mechanical losses averaging about 0.8%, the percentage recovery of the refining process is approximately 90%, comparable to the yield obtainable by the basic open-hearth process. In the progress of the high purity oxygen blowing, up to about the eighth minute, oxidation of the iron progresses under formation of comparatively large amounts of FeO, which, as above stated, promotes a desirable quick liquefaction of the basic lime slag. At this stage in the blow, the slag shows maximum values of from 25–30% FeO. In the further course of the process reduction of Fe from the slag occurs which continues until the carbon content of the bath of about 0.07% is reached. The FeO in the slag decreases to about 10–12%. On further removal of carbon, the FeO in the slag again increases so that in the final slag generally an iron content averaging 14% is obtained, and only at very low carbon heats does the iron content exceed this value.

Under these known metallurgical conditions above set forth, the total oxygen requirement is calculated on the basis of oxygen pick-up of the heat during the refining period. Summation of these oxygen gas volumes required for the oxidation to complete refining indicate substantially a straight line function on oxygen input, and corresponding to this relative constancy of oxygen input, the oxygen pick-up proceeds uniformly during the blow. The oxygen input is maintained at a rate such that the speed of the refining process insures satisfactory reroduction of FeO from the slag, in the manner set forth above. In actual practice, based on experience in operation of 30 ton converters, oxygen feed rates may be maintained such that depending upon pig iron analysis, amount of scrap addition and desired finished steel analysis, the

refining to usual carbon end points on the order of 0.05% C is completed in from about 15 to about 30 minutes, preferably 18 to 22 minutes. Flow rates of from about 4000 to 8000 cubic meters of oxygen per hour are representative of the oxygen input under these conditions.

In such exemplary commercial practice with 30 ton converters charged to 35 to 36 tons, oxygen pressures at the blast nozzle of about 8 to 10 atmospheres and oxygen jet or blast nozzle diameters of from about 27.5 to 35 millimeters (1.1 to 1.4 inches) with nozzle spacings varying from 25 to 50 inches (about 650 to 1250 millimeters have been used, the preferred spacing being from 30 to 40 inches (about 750 to 1000 millimeters). In general, it may be stated that as the oxygen pressure and nozzle diameter are increased, the nozzle spacing is also increased, for example, as the capacity of the refining vessel and total charge is increased. Under these conditions, deep penetration of the molten metal bath is avoided, while the necessary displacement of the slag cover to maintain direct oxygen to molten metal contact is insured. However, in the unusual circumstances of an abnormally stiff slag cover, the blow may be initiated using mechanical means for penetrating the slag cover to establish oxygen to metal contact.

It is to be noted, that in certain instances particularly where the rate of oxygen input is relatively high, that is, the total blowing time is in the lower portion of the range above stated, the pressure of the oxygen jet at the blast nozzle may be reduced in the last few minutes of the blow to reduce the rate of oxygen input, which is beneficial in supporting the inherent characteristic of the process in regard to avoidance of over-oxidation of the heat. Due to this characteristic of the process, it is generally unnecessary to utilize any deoxidizing agents such as ferromanganese and ferrosilicon in the production of semi-killed steels, and only in the production of killed steels are the conventional deoxidizers employed.

The process has as one of its major advantages the applicability to pig iron of analyses used in ordinary open-hearth practice, which would not be amenable to refining by either the acid Bessemer process or the basic Thomas process. In addition, the process is fully applicable to pig irons having analyses of the type which are normally utilized in either the acid Bessemer or basic Thomas processes. Typical illustrations of the following pig irons and the finished steels produced therefrom indicate that the process produces steels comparable to open-hearth quality from pig irons of widely varying phosphorus and silicon contents.

(1) 4.0% C, 1.5–2.0% Mn, 0.7–1.2% Si, 0.1–0.24% P, 0.05% S, and 0.01% N blown to a finished steel of the following analysis: 0.06% C, 0.35% Mn, 0.00% Si, 0.024% P, 0.025% S, and 0.0025–0.0035% N (oxygen about 98%).

(2) Pig iron analyzing 3.5–4.25% C, 1.4–3.2% Mn, up to 0.3% Si, 0.06–0.1% P, 0.04–0.07% S, and 0.01% N from which steel of the following analysis is obtained: 0.06% C, 0.35% Mn, 0.00% Si, 0.01–0.02% P, 0.022% S, and 0.001–0.002% N.

(3) Illustrative of a grade of pig iron falling between that of normal open-hearth analysis and basic Bessemer pig iron is the following: 3.61% C, 2.16% Mn, 0.46% Si, 0.356% P, 0.062% S. Blowing of such a charge of rather unfavorable chemistry by the process of the invention yielded a steel of the following composition: 0.04% C, 0.15% Mn, 0.0% Si, 0.014% P, 0.045% S. Clearly, such a pig iron would be definitely unsuitable for basic Bessemer (Thomas) process refining, and would also present considerable difficulty if used for open-hearth refining.

The accompanying drawing diagrammatically illustrates a device for carrying out the present invention. In this drawing, reference numeral 1 denotes a metallic wall and 2 the refractory lining of the refining vessel. An oxygen supply lance 3 is centrally positioned and overhung above the charge and is provided with a nozzle

3' for the introduction of the oxygen gas, inserted in an opening of the cover 4. The material charge, including molten pig iron, melted scrap, and slag forming additions, such as limestone, is indicated at 5 and the depth and diameter of the upper surface of the molten bath in the quiescent state are denoted by H and D, respectively. The lance 3 is retractable, and is provided with water cooling ducts and connections (not shown). The cooling water in actual practice is supplied to the lance at a pressure of from 4 to 6 atmospheres and the normal flow rate is about 36 to 40 cubic meters per hour. Under such conditions the temperature of the cooling water increases from approximately 14° centigrade input to a maximum of about 30° centigrade in the effluent from the lance.

In the preferred commercial practice of the invention, a converter shaped vessel with an open mouth is usually provided, through which the lance is inserted into and retracted from operating position, as indicated in the example set forth below. In this manner, suitable gas take off devices may be positioned at the throat of the converter type vessel to collect the off gases and separate the particulate fume therefrom.

The following is a detailed description of a typical operation of the process, which is not to be regarded as a limitation on the invention, but rather as a complete specific embodiment thereof.

Example 1

A closed bottom converter of normally 30 tons (metric) capacity is charged with a total of about 36 tons of metal through an open mouth. The oxygen lance is inserted through the mouth of the converter to the adjusted distance above the melt surface. The diameter of the surface of the bath with such a charge is about 5 meters and the depth of the bath about 1 meter. A typical cycle of operations is given below on a time table basis.

	Hours
7100 kg. plant return scrap charged to converter	0
29,600 kg. pig iron poured from mixer into converter having an analysis as follows: 4.04% C, 0.99% Si, 1.73% Mn, 0.153% P, and 0.045% S	0.08
Addition of 850 kg. limestone and 60 kg. bauxite	0.10–0.13
Introduction of nozzle, oxygen jet initiated at a nozzle pressure of 10 atmospheres (147 p. s. i.) with a nozzle spacing above the bath of 1000 millimeters	0.15
850 kg. limestone and 200 kg. rolling mill iron slag added	0.16
750 kg. limestone chips added in five parts of 150 kg. each	0.22–0.28
Oxygen pressure reduced to 8 atmospheres	0.30
Mouth flame transparent, nozzle withdrawn, oxygen supply turned off—end of blowing time at 19 minutes	0.34
Converter contents sampled and analyzed as follows: 0.05% C, 0.00% Si, 0.31% Mn, 0.024% P, 0.02% S	0.35
Slag drawn off	0.35–0.39
150 kg. Spiegel iron added to contents of converter	0.39
Slag remaining in converter stiffened with 30 shovelfuls of limestone	0.39–0.42
Steel poured into pan, temperature measured at 1575° C., 6 kg. electrofour added to pan	0.42–0.45

Final test analysis on pouring into ingot mold was: 0.07% C, 0.32% Mn, 0.022% P, 0.020% S, 0.0035% N. Oxygen consumption 1950 cubic meters. This oxygen consumption is about 54 cubic meters (measured at standard conditions) per ton and compares with a theoretical oxygen requirement of 51 cubic meters (measured at standard conditions), and therefore indicates an oxygen efficiency of 95%.

The process of the present invention may be also applied to the production of metals, for example, production of steel, from solid starting materials. In the production of steel, pig iron and scrap iron, and if desired certain alloys and fuels, such as coal or wood, are introduced into the refining vessel. As materials for producing heat for melting, coke, ferrosilicon, calcium carbide, aluminum alloys and the like, which are converted into slag or gaseous products at the prevailing refining temperatures can be added. The total amount of the starting material mixture may be introduced as a single charge prior to initiation of the melting, or may be gradually fed in small incremental amounts. Sufficient fuel should be present for producing the combustion necessary to provide the heat of fusion of the solid charge. After ignition of the fuel, melting of the initial mixture is brought about by the action of the oxygen jet.

The melting procedure is started by means of an ignited body which is introduced immediately prior to the initiation of blowing of the oxygen jet, and is preferably positioned at that portion of the solid charge where the oxygen jet comes in direct contact therewith.

Thus, according to the present invention, a steel may be produced with a minimum consumption of fuel, for foundries or rolling mills, by melting the iron to be converted into steel with low grade fuel and a high purity oxygen jet blast, for example, in cupola furnace, or in a converter type vessel itself, and subjecting the thus melted solid charge to high purity oxygen refining in the above described manner in a suitable refining vessel, such as a converter. In carrying out such a melting and refining treatment with high purity oxygen, the energy consumption is extremely low, amounting to only 100 cubic meters of oxygen (measured at standard conditions) per ton of steel produced. Of course, as indicated above in the refining of primarily hot metal charges constituting pig iron with analyses as set forth above to refine steels of 0.05% carbon content and analyzing as above indicated, the average oxygen consumption is only about 57 cubic meters per ton (measured at standard conditions).

The present process of surface blowing with high purity oxygen is also applicable to the desulfurization of copreous materials and to the production of glass in the converter with the use of sodium chloride. Furthermore, the process is applicable to the treatment of blast furnace slag to the elimination of sulfur and conversion of slags into melted cement or glass-like materials of the type used for the manufacture of slag wool.

This application is a continuation-in-part of my copending application Serial No. 206,147, filed January 16, 1951, now abandoned. It will be understood that the present invention is not limited to the specific materials, steps and other specific details described above and may be carried out with various modifications without departing from the scope of the invention as defined in the appended claims.

We claim:

1. Method of refining molten impure iron in the presence of a slag in a vessel having a refractory lining by blowing with oxygen, which comprises discharging a stream of oxygen vertically downwardly through the slag layer onto and below the surface of the bath at the central portion thereof, to an extent to avoid material agitation of the bath by the oxygen stream, the contact of the oxygen with the bath resulting in reaction of the oxygen with a portion of the iron and with the oxidizable impurities of the bath in a localized reaction zone spaced a substantial distance from the refractory lining, the reactions in said zone resulting in refining of the iron and gas evolution and in the production of high temperature in the reaction zone away from the refractory lining, said reaction producing a circulatory movement in the molten metal, which circulatory movement brings those portions of the molten metal bath which are remote from the reaction zone into the reaction zone whereby those portions are subjected to said reaction with minimum injury to the refractory lining.

2. The gaseous oxygen process set forth in claim 1 in which the oxygen is blown into said vessel under pressure in a range between about five and about twenty-five atmospheres above normal atmospheric pressure.

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METHOD OF CARRYING OUT MELTING PROCESSES

Theodor Eduard Suess, Luxembourg, and Herbert Trenkler, Hubert Hauttmann, and Rudolf Rinesch, Linz (Danube), Austria; said Suess assignor to Vereinigte Osterreichische Eisen- und Stahlwerke Aktiengesellschaft, Linz (Danube), Austria, a corporation of Austria

SPECIFICATION

This invention relates to a process for the treatment of metallic or metal-containing materials with oxygen-containing gases, preferably high purity oxygen, and has particular relation to a process of this type in which fusible materials are treated at high temperatures with said gases. Still more particularly, the invention relates to a process for the refining of molten metal with high purity oxygen blown downwardly onto the surface of a bath of the molten metal.

The invention is particularly adapted to the refining of primarily hot metal charges, for example, molten pig iron, but it is also applicable to the production of refined metals from solid charges, such as solid pig iron for the production of steel, as hereinafter set forth. The invention is also characterized by the fact that the heat required for the refining of the molten impure metal is autogenous, being produced primarily by reaction of the oxygen gas with the impurities in the molten metal, although when utilizing solid charges of impure metal, the heat required for melting of the charge prior to refining is provided by combustion of a suitable fuel with the oxygen gas.

Processes for the utilization of high purity oxygen in the refining of molten metal charges, such as pig iron, have been suggested ever since the development of the original pneumatic process by Bessemer. Attempts to blow with high purity oxygen in a conventional Bessemer or Thomas converter through bottom tuyeres has resulted in the destruction of the refractory bottom within the short time of one heat. On the other hand, high purity oxygen refining processes have been previously proposed in which the oxygen is directed onto the molten metal bath surface in the form of a jet or jets issuing from tuyeres positioned in the wall of the refining vessel above the melt line. In such processes, the horizontal velocity component of the oxygen jet at the melt surface causes the development of excessively high temperatures above and at the melt-slag interface on the side of the vessel opposite the tuyeres or oxygen jet inlet so that a rapid deterioration of refractory occurs. In addition, with such an inclined oxygen jet, a loss of oxygen efficiency results due to deflections of the gas from the melt surface and burning of a large proportion (40-50%) of the evolved carbon monoxide to carbon dioxide above the melt, which is further undesirable in contributing to the short refractory life. In addition, the heat produced by high purity oxygen-molten metal reactions is more than sufficient to provide the heat necessary for completion of the refining reactions to the desired steel analysis, and this large amount of additional heat developed within the refining vessel due to carbon monoxide combustion is undesirable. Further, in the utilization of high purity oxygen as the refining medium, the reduction in oxygen efficiency resulting from this combustion of the carbon monoxide with a portion of the oxygen feed cannot be tolerated.

Accordingly, it is recognized that the application of such processes, in which the molten materials, for example pig iron, are treated in refining devices provided with refractory linings are severely limited due to the extremely high temperatures developed by reaction of the high purity oxy-

gen gas with the molten metal and the short life of the refractory linings when exposed to such temperatures. This is particularly true in those processes, such as production of steel, in which chemical reactions capable of causing corrosion of the refractory lining take place. Thus, in a device provided with refractory lining, such as a converter in the previously proposed processes when high purity oxygen is blown to the surface of a bath of molten pig iron, with or without a slag cover, combustion of the impurities in the metal, and also iron itself result in such extremely high temperatures that the refractory lining is attacked and damaged to such extent that it must be renewed after a short period of use. The refractory materials known at present are unable to resist attacks and stresses of this kind unless the lining is protected by the application of particular conditions from direct exposure to the strong heat developed by the high purity oxygen-molten metal reactions. Accordingly, although the advantages of molten metal refining with high purity oxygen have been recognized, particularly with respect to the reduced nitrogen ballast compared to the air blown pneumatic refining processes, there remains no economical, commercially feasible process for refining of molten metal with high purity oxygen capable of providing long refractory life and high oxygen efficiency. In particular, the deficiencies of the proposed processes, emphasize the lack of a high purity oxygen refining process for molten pig iron having the aforementioned advantages to provide an economical, commercially feasible process for production of refined steel at least equal in quality to that produced by the well known basic open-hearth process from pig iron of widely varying chemical compositions.

It is accordingly one of the main objects of the present invention to provide a process for refining molten metals by surface blowing with high purity oxygen, in which, owing to the particular conditions employed, the refractory walls of the apparatus utilized in carrying out the process are

protected from undue corrosion by the excessively high temperatures developed and the chemical reactions taking place at such temperatures.

Another object of the present invention is to carry out the treatment of molten metals, and other molten materials by surface blowing with high purity oxygen in such a manner that the reactions of the oxygen gas with the constituents of the molten bath and the resulting high temperatures, to the extent possible, are limited to an oxygen jet impingement area removed from the refractory lining of the reaction vessel.

It is also a primary purpose and object of this invention to provide a process for the refining of primarily hot metal charges, that is, predominantly molten pig iron, with high purity oxygen gas in which controlled refining at substantially theoretical oxygen efficiency is accomplished.

A further object is to provide a process for refining of molten pig iron with a surface blown high purity oxygen jet in which an exceptionally high refractory life is obtained.

The invention also has as its object to provide a process of surface blowing molten pig iron with high purity oxygen in which the refining reactions and oxygen impingement on the melt surface are controlled in a manner such that overoxidation of the molten pig iron bath is essentially avoided.

It is still another object of the invention to provide a high purity oxygen refining process which is applicable to pig iron of widely varying chemical compositions, including in particular pig iron of analyses used in ordinary basic open-hearth practice, as well as those of higher silicon and phosphorus content required for blowing in the acid Bessemer and basic Thomas converter processes to produce steels having analyses and qualities at least comparable to that of basic open-hearth steels. Another object of the invention is to provide a high purity oxygen refining process

for production of steel of excellent quality at a high rate of production, substantially comparable to Bessemer or Thomas converter practice, for example, a blowing time of from 15 to 30 minutes for charges of from 30 to 40 tons to carbon end points of 0.05% or below.

Further objects and advantages of the invention will be apparent from the following detailed description of the process and the appended drawing.

The process of the invention generally comprises refining the molten metal in a converter type or other suitable vessel with a high purity oxygen jet impinging vertically or approximately vertically on the melt surface substantially at the central portion thereof by means of a blast nozzle or other suitable jet producing means under controlled conditions, hereinafter defined, to supply to the molten metal the required amount of oxygen for completion of refining within a predetermined time, and to produce autogenous heat sufficient to insure completion of the refining and adequate temperature in the refined charge for subsequent handling.

It has been found that by suitable arrangement of the nozzle or jet producing device, and operation thereof for the supply and introduction to the molten metal of the high purity oxygen gas, suitable design of the refractory lined refining device in which the process is conducted, and proper use of amounts of materials charged, the foregoing advantages are obtained, including a very efficient protection of the refractory lining.

According to the process of the invention, the high purity oxygen jet is blown vertically, or approximately vertically upon the central portion of the surface of a bath of the molten metal, the jet having a diameter and static pressure at the point of origin, that is, at the blast nozzle or other jet producing means, and the point or origin (blast nozzle) being spaced from the bath surface, such that direct con-

tact of the oxygen jet and the molten metal is established and maintained throughout the refining period without deep penetration of the molten metal bath by the jet. In so operating, the area of jet impingement is controlled to produce a relatively confined zone of direct oxygen to molten metal contact with respect to the total surface area of the bath. It has been determined in application of the present invention to the refining of predominantly molten pig iron charges by means of high purity oxygen, that the jet blown onto the surface of the molten iron, as above described, under a relatively low static pressure at the point of origin, for example, at the overhung blast nozzle, of from 5 to 25 atmospheres (about 75 to 375 pounds per square inch), preferably at about 8 to 12 atmospheres (about 115-175 pounds per square inch), with the jet diameter at the point of origin or blast nozzle being about 1 millimeter (1/25 inch) per ton of charge, and with the point of origin or blast nozzle spaced from the bath surface from at least 150 millimeters (about 6 inches) up to about 2000 millimeters (about 80 inches), produces a sufficiently high reaction velocity of the oxygen with the bath constituents to insure the development of autogenous heat at a rate sufficient to provide the heat required for completion of the refining in a minimum of time, consistent with controlled temperature and control and development of other necessary and required process conditions, such as fluid slag, avoidance of over-oxidation (undue loss of iron to the slag), and avoidance of slopping. The process conducted under these conditions avoids a deep penetration of the oxygen gas into the molten bath which seriously impairs refractory life at the bottom of the refining vessel. In addition, the impingement area of the high purity oxygen on the central portion of the bath isolates the refractory walls of the refining vessel from the extremely high temperatures which are developed by the direct reaction of the oxygen and the molten metal.

It has also been found, according to the invention, that

the utilization of suitable design of reaction vessel and the use of the proper amount of material charged results in a ratio of the depth of the bath to the surface area of the bath which augments the protection afforded to the refractory lining of the refining vessel and is also beneficial to the progress of the refining reactions to produce finished steels of low impurity content comparable to those produced by the basic open-hearth process. In carrying out the process of high purity oxygen refining of a molten bath of pig iron, the refining vessel is of such design and the charge is of such amount that the radio of the depth of the molten bath in meters to the surface area of the molten bath in square meters should be from about 1 to 5 to about 1 to 28 in refining vessels of various design or in terms of the ratio of depth to diameter of a circular bath between 1:2.5 and 1:19. In other metallurgical processes to which the present invention is adapted substantially similar ratios may be used.

Although it is not intended to limit the present invention to any specific theory of action or mechanism, it is believed that application of the oxygen jet substantially vertically or approximately vertically upon the central portion of the bath surface brings about a flow in the molten metal from the center of the surface of the bath downwardly and then along the bottom of the refining vessel, and upwardly at the sides of the vessel to the surface of the bath, so that portions of the unrefined metal are continuously presented to a localized center of direct oxygen reaction with the bath metal, while reacted or oxidized portions of the bath move away from this reaction center. This apparent circulation of the molten material is facilitated by shaping of the bottom of the device in its refractory lining in a uniformly curved design, preferably hemispherical or similar shape, so as to offer the minimum of resistance to the circulation.

Due to the very high affinity of oxygen for iron, initial contact of the high purity oxygen jet with the molten metal bath causes a rapid combination of oxygen and iron to

form FeO in the confined central reaction zone. This is demonstrated by ignition of the oxygen and the propagation of a visible flame within the first minute of blowing. This reaction, together with oxidation of impurity elements, such as silicon and managanese, develops extremely high temperatures in the zone of direct oxygen contact with the molten metal which approach the boiling point of iron, as demonstrated by the evolution of a fume containing iron oxide and managanese oxide. A portion of the iron oxide goes to the slag with the other oxidized elements and a portion diffuses into the bath under the influence of the bath circulation, so that within the first three minutes of the blowing vigorous carbon combustion is initiated due to the high temperatures developed by these reactions. The ensuing reaction of carbon with the FeO and directly with the oxygen gas in the confined direct oxidation zone causes rapid formation of carbon monoxide and the formation of this CO causes a strong boil or agitation of the bath, which augments the bath circulation to continuously present unrefined metal to the oxygen gas reaction zone and to create a slag-metal emulsion. The oxygen jet thus contacts the emulsion of bath and slag components which presents a larger reaction surface and causes the refining reactions to progress rapidly although the oxygen jet does not penetrate deeply into the molten metal bath and is confined to an impingement area at the central portion of the bath surface. This vigorous boiling action is opposed by the pressure of the oxygen jet only in the area of impingement, and outside of this area it represents primarily endothermic reduction of FeO by carbon to form the evolved carbon monoxide, which reaction thus effectively encompasses the zone of direct oxygen reaction at which the highest temperatures prevail affording a maximum measure of protection to the refractory lining of the refining vessel.

In conducting the process in the manner set forth above, the advantage of exceptionally high refractory life is obtained. For example, in refining of pig iron having the

following chemical composition: carbon 3.8-4.2, silicon 0.6-1.3, managanese 1.4-2.2, phosphorus 0.120-0.250, and sulfur 0.045 max., and a slag having the following composition SiO_2 12-17%, CaO 38-44%, MgO 5-10%, MnO 9-13%, P_2O_5 1.2-1.8%, and Fe 12-17%, in a 30 ton converter, the average durability of the refractory is over 200 heats (foregoing in percentages by weight). By comparison, in basic Bessemer practice utilizing air rather than high purity oxygen, the removable converter bottom must be relined after only 35 to 60 heats. In addition, the refractory life obtainable by the process of the invention surpasses that obtained in normally operated open-hearth practice in that in refining of a normal charge by basic open-hearth about 36 lbs. of refractory brick is consumed per ton of steel produced to which must be added some 40 pounds of sintered dolomite for fettling operations, whereas total refractory consumption in the instant process is only about 24 lbs. per ton of steel produced. This advantage is even greater when compared to oxygen lancing in an open-hearth which accelerates refractory consumption.

The further advantage of high oxygen efficiency is obtainable according to the process of the invention when the oxygen jet impinges on the central portion of the molten bath surface from directly above, that is, approximately vertically. Oxygen efficiencies calculated on the basis of total oxygen input compared to oxygen consumed in the bath reactions is approximately 95%. This is demonstrated by an average oxygen consumption of only 57 normal cubic meters (measured at standard conditions of temperature and pressure) per ton of steel including oxygen consumption for heating the converters after relining. This compared with calculated or theoretical oxygen requirements for the refining of the various pig irons blown to steel analyses set forth below represents about a 95% efficient utilization of oxygen. In addition, analyses of waste gases effluent from the converter indicate that the carbon in the instant process burns almost 100% to carbon monoxide,

the analyses showing on the average over 90% CO and less than 10% CO_2, indicating that the oxygen input is not lost by burning with the carbon monoxide above the melt within the refining vessel, as in the case of low angle impingement from tuyeres positioned in the side walls of the refining vessel. Moreover, this is a distinct advantage in the instant process, since the reaction of the oxygen with the melt provides more than sufficient heat for the refining, and additional heat by burning of the carbon monoxide to carbon dioxide above the melt is to be avoided. The potential heat units in the effluent carbon monoxide may be utilized in various ways by subsequent burning.

As above mentioned, it is a characteristic of the process of the invention that in the confined zone of direct oxygen reaction at the surface of the molten metal bath, the oxidation products of the impurities in the pig iron, such as silicon and managanese, as well as the oxidized iron form an early fluid slag which is always very rich in oxides, that is, highly oxidizing. With the formation of the slag-metal emulsion, the iron oxide reacts with the carbon present in the bath, primarily outside of the direct oxygen-metal reaction zone, and since such slag-metal reactions are endothermic, the molten bath is maintained cooler in the vicinity of the walls of the refining vessel or converter. For example in the formation of one kg. of FeO, by direct oxidation with the oxygen jet and absorbed as iron silicate into the slag, 80 kg. calories of heat are developed. An equal amount of heat is absorbed outside of the confined central zone of direct oxidation as the FeO (as silicate) is reduced by the carbon in the bath, as one example of slag metal reactions occurring during the blowing.

This formation of an early highly oxidizing fluid slag is of particular value in basic refining when the process is applied to pig iron of analyses used in ordinary open-hearth practice, which would not be amenable to refining by either the acid Bessemer process due to the phorphorus content, or the basic Thomas process due to the lack of sufficient

phosphorus. With the rapid heating of the slag cover and metal bath, the proper amounts of lime or lime supplying substance, such as limestone, may be added at the beginning of the blow and during the blow to insure formation and maintenance of a slag of sufficient basicity. Thus, the early fluid, basic and highly oxidizing slag formed provides an accelerated rate of phosphorus and sulfur removal from the bath, leaving the finished steel very low in both elements. With normal open-hearth pig irons having phosphorus contents ranging from about 0.1-0.35%, and even higher, e. g., 0.85% P, and with correct lime additions, final phosphorus contents not higher than about 0.025% and as low as 0.010% are obtained by the time the carbon end point is reached with only a single slagging operation. With sulfur contents in the pig iron of from 0.045 to 0.08%, the sulfur is decreased to 0.02-0.025%, and on the lower range of sulfur in the pig iron to values as low as 0.012%. In usual operations, from 1 to about 4.5% lime is charged to obtain the foregoing result, depending upon the phosphorus content in the pig iron. In addition, all of the lime requirement may be added during initial charging before blowing is started, particularly where the silicon content of the pig iron, which is one of the first oxidized elements, is sufficiently high. On the other hand, the lime may be charged in increments during the blow, but with a sufficient amount initially charged to provide a basicity adequate to absorb the phosphorus.

In the normal range of phosphorus in pig iron of basic open-hearth quality from about 0.1 to 0.35%, the required slag volume including the lime charge is advantageously much lower than the slag volume in the bottom blown basic Thomas process. The iron content of the slag varies from about 9 to 18%, with generally higher FeO content in the slag at higher phosphorus contents in the pig iron, and also at lower managanese contents. Accordingly, the lower percentage of slag, for example, 11 to 12% compared to about 22% in the Thomas process results in comparable or lower total iron content lost to the slag, even though the FeO

content of the slag may be higher than the usual 10% in the basic Thomas process.

The process in its preferred embodiment utilizes high purity oxygen, by which the term is meant oxygen gas analyzing at least 97% O_2. For minimum nitrogen content in the finished steel of at least 98% oxygen and preferably 99% or higher should be utilized. The frequency curves based on produced steel analyses indicate that oxygen of at least 98% purity provides a peak or maximum at a nitrogen content of from 0.002 to 0.003%, with 95% of all heats blown showing a nitrogen content of 0.004% or less.

The vigorous boil, above mentioned, continues up to the carbon end point, and together with the induced circulation of the bath metal toward and away from the central zone of direct oxygen reaction, effectively counteracts any tendency to overoxidation of the bath. When the flame dies and carbon combustion is completed, the bath becomes relatively quiet and intimate contact between slag and metal bath ceases. The turbulence of the bath and slag due to the oxygen stream impinging from directly above is insufficient to cause continuance of oxygen-metal reactions. As a result, steels blown by the process of the invention do not suffer from the deteriorating effects of high oxygen (FeO) contents. Direct oxygen determination by the hot extraction method yielded oxygen contents of 0.04% maximum for heats that were blown to a carbon end point of from 0.05 to 0.10% C. Thus, the oxygen content of steels produced by the high purity oxygen blowing process compare very favorably with oxygen contents of basic open-hearth steel in the same carbon range, and are definitely lower in oxygen content than bottom blown Bessemer steels using air, oxygen enriched air, oxygen and steam, or other gas mixture.

As in the basic Bessemer process, the silicon is rapidly eliminated. However, in contrast to the basic Bessemer process, the use of high silicon charges presents no prob-

lem due to the fact that slopping is not encountered in the process of the invention to any degree similar to that in the bottom blown Bessemer practice. In fact, higher silicon pig irons actually are advantageous in the high purity oxygen blowing due to the heat producing effect of this element in the early stages of the blow with the result that higher scrap charges can be made in the process.

Regarding scrap additions, the process advantageously may utilize scrap charges of up to about 30%, depending primarily upon the silicon content of the pig iron, and also on the temperature of the hot metal charge. For lower ranges of silicon, such as 0.3 to 0.7% scrap charges of from 10 to 15% are permissible. With silicon in amounts from 1 to 1.2%, scrap charges of 20 to 25% may be utilized.

In general, the managanese content of the fully blown metal and of the slag increases with the total manganese content (pig iron and scrap). However, it is a characteristic of this oxygen steel making process that the high temperatures developed in the reaction zone between the bath metal and the slag cause a rereduction of manganese from the slag into the bath during the latter portion of the refining period. In the last minutes of the blow, the manganese content in the bath again decreases as the carbon drops to its final value, that is, at a normal end point of 0.04-0.06. Accordingly, the manganese content in the finished steel and in the slag is subject to some control, and is governed by slag composition and volume, temperature and final carbon content. With the use of a minimum amount of slag rich in iron oxide, for example only 70 kg. per ton of steel, the amount of loss of managanese to the slag by burning may be considerably reduced. As above mentioned, extensive tests have shown that the amount of slag can be kept considerably lower than the conventional pneumatic process, such as the Bessemer and Thomas processes. Under these conditions of high developed temperature in the refining process and low slag volume with high iron oxide content,

a finished steel containing managanese in quantities at least 10 times the amount of carbon, for example, 0.6 to 0.8 Mn at carbon end points of 0.05% are obtainable. Accordingly, it is possible to pour rimming steels down to relatively very low carbon contents without any addition of managanese and deoxidizing agents. Under actual operating conditions the best practice for production of standard grades is to refine down to 0.06-0.08% C and to recarburize in the ladle. This practice results in a manganese content of from 0.6 to 0.8 and eliminates the necessity for manganese additions to conform with the usual analysis specifications. The above manganese content easily compares with the conventional composition of rimming low-carbon open-hearth steels, in fact such analyses are near the upper limit of the range. It is also possible to catch the heat at higher carbon contents, so that the resulting content in manganese will be of a higher order than is normally encountered in rimming open-hearth steels of identical carbon content. Thus, it is possible to produce rimming low carbon high purity oxygen blown steels of a predetermined strength which is based on an inherently higher manganese content of the heat.

It has also been found that a steel containing 0.1% carbon and as high as 1.5% manganese may be obtained, for example by the addition of ordinary blast furnace ferromanganese, e. g., 15 kg. of 48% blast furnace ferromanganese per ton suffices, and results in an increase of about 0.05% in the carbon content. In normal steel making operations it was not previously possible to obtain such steels without the use of expensive refined ferromanganese products. Steels of such analyses, not only exhibit increased toughness and yield strength but other properties, such as pressure weldability, are improved.

To exemplify the high manganese recovery in the steel without ferromanganese additions after the blow, the results of the following heats are provided. As indicated above, since the managanese content, under otherwise equal

conditions, increases in the finished steel with increase in pig iron, it is to be noted that particularly high manganese content pig irons were employed. Nevertheless, it is evident that due to the extremely high temperatures developed in this high purity oxygen process, a manganese recovery is possible which cannot be reproduced in known processes.

Heat No. 1.—Pig iron analysis: 4.16% C, 3.02% Mn, 0.14% Si, 0.074% P, 0.040% S. Last converter control test (without ferromanganese or deoxidizers): 0.09% C, 0.96% Mn, 0.005% Si, 0.039% P, 0.013% S, 0.007% N_2.

Heat No. 2.—Composition of pig iron: 4.30% C, 3.24% Mn, 0.33% Si, 0.072% P, 0.034% S. Last converter control test (without ferromanganese or deoxidizer): 0.08% C, 1.02% Mn, 0.005% Si, 0.037% P, 0.010% S, 0.004% N_2.

Heat No. 3.—Composition of pig iron: 4.21% C, 2.88% Mn, 0.27% Si, 0.076% P, 0.044% S. Last converter control test (without ferromanganese or deoxidizer): 0.07% C, 0.95% Mn, 0.005% Si, 0.037% P, 0.012% S, 0.004% N_2.

From the foregoing test, it may be seen that manganese recovery at least 10 times as high as the final carbon content in the finished steel is obtainable by the process of the invention utilizing pig iron having manganese on the order of 3%.

In regard to output, the combustion of the impurities of the pig iron and the iron content of the slag total a loss of about 8.0% with an additional 0.8% of iron lost in the dust fume from the process. With mechanical losses averaging about 0.8%, the percentage recovery of the refining process is approximately 90%, comparable to the yield obtainable by the basic open-hearth process. In the progress of the high purity oxygen blowing, up to about the eighth minute, oxidation of the iron progresses under formation of comparatively large amounts of FeO, which, as above stated, promotes a desirable quick liquefaction of the basic lime slag. At this stage in the blow, the slag shows maximum

values of from 25-30% FeO. In the further course of the process reduction of Fe from the slag occurs which continues until the carbon content of the bath of about 0.07% is reached. The FeO in the slag decreases to about 10-12%. On further removal of carbon, the FeO in the slag again increases so that in the final slag generally an iron content averaging 14% is obtained, and only at very low carbon heats does the iron content exceed this value.

Under these known metallurgical conditions above set forth, the total oxygen requirement is calculated on the basis of oxygen pick-up of the heat during the refining period. Summation of these oxygen gas volumes required for the oxidation to complete refining indicates substantially a straight line function on oxygen input, and corresponding to this relative constancy of oxygen input, the oxygen pick-up proceeds uniformly during the blow. The oxygen input is maintained at a rate such that the speed of the refining process insures satisfactory rereduction of FeO from the slag, in the manner set forth above. In actual practice, based on experience in operation of 30 ton converters, oxygen feed rates may be maintained such that depending upon pig iron analysis, amount of scrap addition and desired finished steel analysis, the refining to usual carbon end points on the order of 0.05% C is completed in from about 15 to about 30 minutes, preferably 18 to 22 minutes. Flow rates of from about 4000 to 8000 cubic meters of oxygen per hour are representative of the oxygen input under these conditions.

In such exemplary commercial practice with 30 ton converters charged to 35 to 36 tons, oxygen pressures at the blast nozzle of about 8 to 10 atmospheres and oxygen jet or blast nozzle diameters of from about 27.5 to 35 millimeters (1.1 to 1.4 inches) with nozzle spacings varying from 25 to 50 inches (about 650 to 1250 millimeters have been used, the preferred spacing being from 30 to 40 inches (about 750 to 1000 millimeters). In general, it may be stated

that as the oxygen pressure and nozzle diameter are increased, the nozzle spacing is also increased, for example, as the capacity of the refining vessel and total charge is increased. Under these conditions, deep penetration of the molten metal bath is avoided, while the necessary displacement of the slag cover to maintain direct oxygen to molten metal contact is insured. However, in the unusual circumstances of an abnormally stiff slag cover, the blow may be initiated using mechanical means for penetrating the slag cover to establish oxygen to metal contact.

It is to be noted, that in certain instances particularly where the rate of oxygen input is relatively high, that is, the total blowing time is in the lower portion of the range above stated, the pressure of the oxygen jet at the blast nozzle may be reduced in the last few minutes of the blow to reduce the rate of oxygen input, which is beneficial in supporting the inherent characteristic of the process in regard to avoidance of over-oxidation of the heat. Due to this characteristic of the process, it is generally unnecessary to utilize any deoxidizing agents such as ferromanganese and ferrosilicon in the production of semi-killed steels, and only in the production of killed steels are the conventional deoxidizers employed.

The process has as one of its major advantages the applicability to pig iron of analyses used in ordinary open-hearth practice, which would not be amenable to refining by either the acid Bessemer process or the basic Thomas process. In addition, the process is fully applicable to pig irons having analyses of the type which are normally utilized in either the acid Bessemer or basic Thomas processes. Typical illustrations of the following pig irons and the finished steels produced therefrom indicate that the process produces steels comparable to open-hearth quality from pig irons of widely varying phosphorus and silicon contents.

(1) 4.0% C, 1.5-2.0% Mn, 0.7-1.2% Si, 0.1-0.24% P, 0.05% S, and 0.01% N blown to a finished steel of the following

analysis: 0.06% C, 0.35% Mn, 0.00% Si, 0.026% P, 0.025% S, and 0.0025-0.0035% N (oxygen about 98%).

(2) Pig iron analyzing 3.6-4.25% C, 1.4-3.2% Mn, up to 0.3% Si, 0.06-0.1% P, 0.04-0.07% S, and 0.01% N from which steel of the following analysis is obtained: 0.06% C, 0.35% Mn, 0.00% Si, 0.01-0.02% P, 0.022% S, and 0.001-0.002% N.

(3) Illustrative of a grade of pig iron falling between that of normal open-hearth analysis and basic Bessemer pig iron is the following: 3.61% C, 2.16% Mn, 0.46% Si, 0.856% P, 0.062% S. Blowing of such a charge of rather unfavorable chemistry by the process of the invention yielded a steel of the following composition: 0.04% C, 0.15% Mn, 0.0% Si, 0.014% P, 0.045% S. Clearly, such a pig iron would be definitely unsuitable for basic Bessemer (Thomas) process refining, and would also present considerable difficulty if used for open-hearth refining.

The accompanying drawing diagrammatically illustrates a device for carrying out the present invention. In this drawing, reference numeral 1 denotes a metallic wall and 2 the refractory lining of the refining vessel. An oxygen supply lance 3 is centrally positioned and overhung above the charge and is provided with a nozzle 3' for the introduction of the oxygen gas, inserted in an opening of the cover 4. The material charge, including molten pig iron, melted scrap, and slag forming additions, such as limestone, is indicated at 5 and the depth and diameter of the upper surface of the molten bath in the quiescent state are denoted by H and D, respectively. The lance 3 is retractable, and is provided with water cooling ducts and connections (not shown). The cooling water in actual practice is supplied to the lance at a pressure of from 4 to 6 atmospheres and the normal flow rate is about 36 to 40 cubic meters per hour. Under such conditions the temperature of the cooling water increases from approximately 14° centigrade input to a maximum of about 30° centigrade in the effluent from the lance.

In the preferred commercial practice of the invention, a converter shaped vessel with an open mouth is usually provided, through which the lance is inserted into and retracted from operating position, as indicated in the example set forth below. In this manner, suitable gas take off devices may be positioned at the throat of the converter type vessel to collect the off gases and separate the particulate fume therefrom.

The following is a detailed description of a typical operation of the process, which is not to be regarded as a limitation on the invention, but rather as a complete specific embodiment thereof.

Example 1

A closed bottom converter of normally 30 tons (metric) capacity is charged with a total of about 36 tons of metal through an open mouth. The oxygen lance is inserted through the mouth of the converter to the adjusted distance above the melt surface. The diameter of the surface of the bath with such a charge is about 5 meters and the depth of the bath about 1 meter. A typical cycle of operations is given below on a time table basis.

	Hours
7100 kg. plant return scrap charged to converter	0
29,600 kg. pig iron poured from mixer into converter having an analysis as follows: 4.04% C, 0.99% Si, 1.73% Mn, 0.153% P, and 0.045% S	0.08
Addition of 850 kg. limestone and 60 kg. bauxite	0.10-0.13
Introduction of nozzle, oxygen jet initiated at a nozzle pressure of 10 atmospheres (147 p. s. i.) with a nozzle spacing above the bath of 100 millimeters	0.15
850 kg. limestone and 200 kg. rolling mill iron slag added	0.16
750 kg. limestone chips added in five parts of 150 kg. each	0.22-0.28

Oxygen pressure reduced to 8 atmospheres	0.30
Mouth flame transparent, nozzle withdrawn, oxygen supply turned off—end of blowing time at 19 minutes	0.34
Converter contents sampled and analyzed as follows: 0.05% C, 0.00% Si, 0.31% Mn, 0.024% P, 0.02% S	0.35
Slag drawn off	0.35-0.39
150 kg. Spigel iron added to contents of converter	0.39
Slag remaining in converter stiffened with 30 shovelfuls of limestone	0.39-0.42
Steel poured into pan, temperature measured at 1575° C., 6 kg. electroflour added to pan	0.42-0.45

Final test analysis on pouring into ingot mold was: 0.07% C, 0.32% Mn, 0.022% P, 0.020% S, 0.0035% N. Oxygen consumption 1950 cubic meters. This oxygen consumption is about 54 cubic meters (measured at standard conditions) per ton and compares with a theoretical oxygen requirement of 51 cubic meters (measured at standard conditions), and therefore indicates an oxygen efficiency of 95%.

The process of the present invention may be also applied to the production of metals, for example, production of steel, from solid starting materials. In the production of steel, pig iron and scrap iron, and if desired certain alloys and fuels, such as coal or wood, are introduced into the refining vessel. As materials for producing heat for melting, coke, ferrosilicon, calcium carbide, aluminum alloys and the like, which are converted into slag or gaseous products at the prevailing refining temperatures can be added. The total amount of the starting material mixture may be introduced as a single charge prior to initiation of the melting, or may be gradually fed in small incremental amounts. Sufficient fuel should be present for producing the combustion neces-

sary to provide the heat of fusion of the solid charge. After ignition of the fuel, melting of the initial mixture is brought about by the action of the oxygen jet.

The melting procedure is started by means of an ignited body which is introduced immediately prior to the initiation of blowing of the oxygen jet, and is preferably positioned at that portion of the solid charge where the oxygen jet comes in direct contact therewith.

Thus, according to the present invention, a steel may be produced with a minimum consumption of fuel, for foundries or rolling mills, by melting the iron to be converted into steel with low grade fuel and a high purity oxygen jet blast, for example, in cupola furnace, or in a converter type vessel itself, and subjecting the thus melted solid charge to high purity oxygen refining in the above described manner in a suitable refining vessel, such as a converter. In carrying out such melting and refining treatment with high purity oxygen, the energy consumption is extremely low, amounting to only 100 cubic meters of oxygen (measured at standard conditions) per ton of steel produced. Of course, as indicated above in the refining of primarily hot metal charges constituting pig iron with analyses as set forth above to refine steels of 0.05% carbon content and analyzing as above indicated, the average oxygen consumption is only about 57 cubic meters per ton (measured at standard conditions).

The present process of surface blowing with high purity oxygen is also applicable to the desulfurization of coprous materials and to the production of glass in the converter with the use of sodium chloride. Furthermore, the process is applicable to the treatment of blast furnace slag to the elimination of sulfur and conversion of slags into melted cement or glass-like materials of the type used for the manufacture of slag wool.

This application is a continuation-in-part of my copending application Serial No. 206,147, filed January 16, 1951,

now abandoned. It will be understood that the present invention is not limited to the specific materials, steps and other specific details described above and may be carried out with various modifications without departing from the scope of the invention as defined in the appended claims.

CLAIMS

We claim:

1. Method of refining molten impure iron in the presence of a slag in a vessel having a refractory lining by blowing with oxygen, which comprises discharging a stream of oxygen vertically downwardly through the slag layer onto and below the surface of the bath at the central portion thereof, to an extent to avoid material agitation of the bath by the oxygen stream, the contact of the oxygen with the bath resulting in reaction of the oxygen with a portion of the iron and with the oxidizable impurities of the bath in a localized reaction zone spaced a substantial distance from the refractory lining, the reactions in said zone resulting in refining of the iron and gas evolution and in the production of high temperature in the reaction zone away from the refractory lining, said reaction producing a circulatory movement in the molten metal, which circulatory movement brings those portions of the molten metal bath which are remote from the reaction zone into the reaction zone whereby those portions are subjected to said reaction with minimum injury to the refractory lining.

2. The gaseous oxygen process set forth in claim 1 in which the oxygen is blown into said vessel under pressure in a range between about five and about twenty-five atmospheres above normal atmospheric pressure.